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## MULTIPLE ABDOMINAL AND PELVIC HYDATID CYSTS (PERITONEAL CYSTS): A STUDY OF 228 CASES.<sup>1</sup>

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### FREQUENCY.

OF the 1,455 records which up to the end of the year 1939 were filed in the Hydatid Registry, 228, that is, approximately 16%, may fairly be regarded as coming under the category of peritoneal cysts. Of these, 108 are separately indexed under the heading "Multiple Abdominal and Pelvic Cysts", and 120 other records, mostly indexed under "Liver", describe such peritoneal cysts as additional findings.

### SEX.

Of the 228 patients, 134 are males and 94 females. This preponderance of males does not necessarily indicate a sex susceptibility to hydatid infection. Male and female children are probably infected in about the same proportion, but as they grow older, boys and young men, from the nature of their pursuits, become more liable than girls and young women to bodily injuries, more liable therefore to laceration of a hydatid cyst that may be bulging from the liver, and to the consequent dissemination of hydatid grafts in the peritoneal cavity.

### AGE.

The ages of the patients are those given at the time of the case recording and range from four to eighty-one. In the first decade there are five cases, in the second 16, in the third 30, in the fourth 53, in the fifth 54, in the sixth 41, in the seventh 21, in the eighth seven, and in the ninth one. These figures indicate that the great majority of patients who first come under the notice of their doctors, are middle aged, but do not indicate the age of the patients when their cysts first came into being. There is good reason to believe that this preceded clinical manifestations by many years, possibly ten, twenty or even more.

<sup>1</sup> Accepted for publication on August 15, 1940.

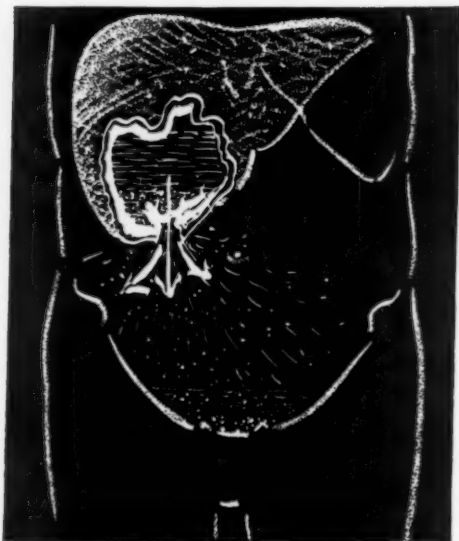


FIGURE I. Primary cyst of liver, fertile but comparatively young and thin-walled and univesicular (no daughters). Rupture of cyst wall and outpouring of fluid and hydatid sand (brood capsules and scolices), the seed of future secondary cysts.

Patients afflicted with multiple peritoneal cysts do not as a rule live to old age, but quite a large number of them reach the fifties or sixties, and *mirabile dictu* lead a fairly happy and useful existence. Approximately 25% of them tell the story of multiple operations extending over ten, twenty or even thirty years.

Of exceptional interest in this connexion are the records number 115, of a female, aged fifty-one years, who underwent 15 operations; number 87, of a male, aged sixty-five years, who underwent 16 operations; number 757,

of a male, aged forty-six years, who underwent 16 operations; number 662, of a male, aged thirty-five years, who underwent 20 operations; number 839, of a female, aged fifty-three years, who underwent 24 operations; number 623, of a male, aged forty-eight years, who underwent 29 operations; number 1358, of a male, aged fifty-eight years, who underwent 29 operations.

#### SECONDARY ORIGIN

The vast majority of these cysts, probably 99% of them, are secondary to preexisting primary cysts of the liver (or much more rarely of spleen or kidney or elsewhere) which had, in the more or less distant past, burst or leaked into the adjacent peritoneal cavity. Thus were disseminated scolices or possibly daughter cysts, some of which, few or many, became engrafted and encapsulated in or under the peritoneum.

FIGURE II. Sequel to Figure I. Secondary cysts, few or many, develop. The parent primary cyst may cicatrize as shown.



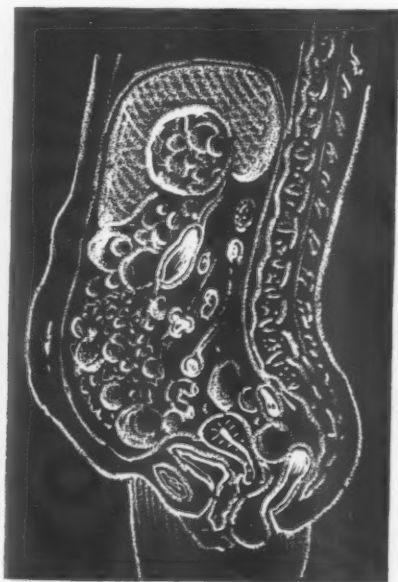
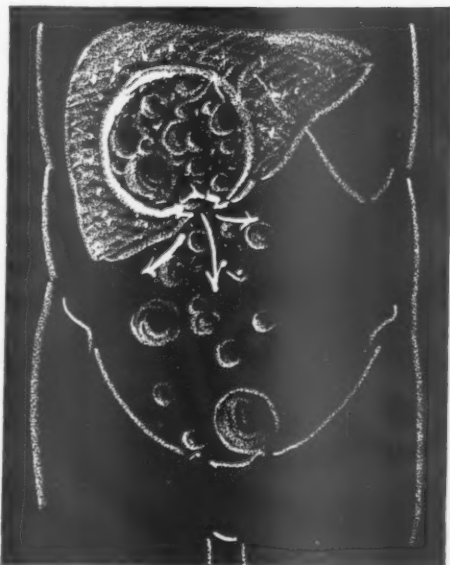
FIGURE III. Primary cyst of liver, old with thick degenerated walls, and filled with daughters (multivesicular). Note escape of contents through rent or necrotic perforation.

Although this is a reasonable assumption, conclusive proof thereof is lacking in the records. In 16 only out of the 228 cases is there a clear description of previous rupture of a primary abdominal cyst due to injury; in the vast majority leakage has been insidious or a forgotten episode of childhood. In 172 out of the 228 cases, approximately 75%, there is, however, a definite statement regarding the associated presence of a liver cyst. Dévé, after a careful study of all available records, claims that 22% of all liver cysts rupture sooner or later.

Primary peritoneal cysts conveyed by way of the arterial circulation do of course occur, but they are really rarities (probably less than 1% of hydatid distribution), and diagnostic errors are common. Even a sleuth-like inquiry into the history and clinical findings may fail to elicit the whole truth, which indeed may be revealed only at autopsy.

Even if an operator who is dealing, say, with a pelvic or a subperitoneal cyst, does think of the likelihood of its being secondary to a liver cyst and therefore makes a manual exploration of that organ, he may fail to find evidence of it, perhaps because the primary cyst has become shrunk and inconspicuous, perhaps because it is located high up on the liver surface, or perhaps because it is hidden by a mass of adhesions. Such difficulties explain and excuse the erroneous label of primary attached to so many recorded cysts in the lower abdominal regions.

FIGURE IV. Sequel to Figure III. Multiple secondary cysts resulting from the escaped daughters. The original primary cyst has closed and has reproduced secondary daughters within its walls.



The cysts most likely to rupture are the moderately young cysts, say, of five or six years' duration, univesicular and of high tension and bulging from the periphery of the liver. Very young cysts, say, of two or three years' duration, have less risk of rupture because of their comparatively small size, and even if they do, they may be immature as regards fertility (acephalocysts) and, if so, would not lead to secondary dissemination. Old cysts of the liver usually contain daughter cysts, are thick-walled and not at high tension. Nevertheless, sometimes they do rupture or perforate and may scatter daughter cysts as well as scolices into the peritoneal cavity.

#### IMPLANTATION CYSTS.

In nine of the cases implantation cysts in the region of the abdominal incision followed a few years after operation. This is a clear indication that dissemination of scolices and perhaps of small daughter cysts occurs fairly frequently at operations unless a careful precautionary technique is followed. Even so, it may be difficult to avoid the spilling of cyst contents into the peritoneal cavity and onto the wound surfaces. The technique of *formolage*, as recommended by Dévé, can be a very helpful preventive in suitable cases, especially those of the univesicular type.

It is well to remember that, according to Dévé, a fertile cyst of average size contains four to five cubic centimetres of hydatid sand, and that in each cubic centimetre there are about 400,000 scolices.

#### Survival of the Shed Scolices.

It does not follow that every scolex or every tiny daughter cyst that escapes from its primary parental home grows into a cyst. In order to survive and develop, the baby offspring or seed has to be of sturdy constitution and the host has to be complaisant and willing to provide the intruder with board and lodging. The vast majority of the seeds fail to take, they are not viable or they abort early. Only the favoured survive and develop; sometimes there is but one, sometimes there are hundreds, sometimes thousands.

#### Influence of Gravity.

The sowing of hydatid seeds in the peritoneal cavity is no doubt influenced by gravity. The escaping hydatid fluid, with which is mixed the hydatid sand, naturally falls to the dependent recesses, for example, the pouch of Douglas if the patient is standing or sitting, the loin pouches if the patient is recumbent.

In four-footed animals experimentally inoculated with hydatid sand and fluid the resulting secondary abdominal cysts are located chiefly about the omentum and mesentery and not in the pouch of Douglas. This is because the body in quadrupeds is usually horizontal and not vertical.

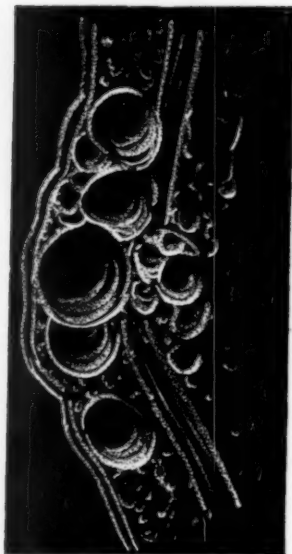


FIGURE V. Implantation cysts in the abdominal wall growing as secondaries in the wound area of a previous operation.



## PSEUDO-TUBERCULOSE HYDATIQUE (DÉVÉ).

Tiny pseudo-tuberculous nodules or granules, dotted sometimes in myriads over the peritoneum, may reveal evidence of a former hydatid scolex invasion. The invaders had dug themselves in and had begun the process of cyst development, but had then succumbed to counter-attack on the part of the host. Their little corpses had then been enclosed in a fibro-cellular shroud and decently interred. They give no definite clinical manifestations and are discovered only at operation or autopsy. Two such cases are included in the Registry—number 941, in a patient aged seven years, and number 1089, in a patient aged forty-five years.

## HETEROTOPIC CYST (DÉVÉ).

By a heterotopic cyst is meant a primary cyst with membranes intact which has escaped or been expelled *holus-bolus* from its original site into the peritoneal cavity (or possibly pleural cavity); it was first described by Dévé some thirty years ago. This is a rare happening, though according to Dew not so rare as is usually supposed. A good example is recorded in the Registry—number 1413, in a patient aged seventeen years.

A small proportion of the cases that have been described as primary cysts of the peritoneal cavity may have this strange origin. The adventitia of a cyst bulging out from the periphery of the liver (or possibly spleen) slowly and gradually fissures open and liberates the unbroken parasitic sphere. This may then by gravity and by the influence of abdominal movements sink into some dependent situation in the serous cavity and there continue its development.

It is conceivable too that a finely pedunculated primary cyst may break from its moorings and develop elsewhere in the abdominal cavity, and cases of this kind are recorded in hydatid literature.



FIGURE VI. Heterotopic primary cyst showing its possible delivery unbroken through its fissured adventitia. Such a cyst may go on growing in the peritoneal cavity.

## CLINICAL FEATURES AND DIAGNOSIS.

*History.*

In 16 only of these Registry records is there a clear history suggestive of a primary cyst having ruptured or leaked some years previously as a result of some injury. The usual story in such cases describes a knock, fall,

crush, strain or what-not, followed promptly by an acute abdominal syndrome with toxic and anaphylactic manifestations, shock, pain, tenderness, rigidity, vomiting, urticaria, and so on. In the vast majority there is no such dramatic and suggestive history. The typical symptoms associated with rupture or leakage have been absolutely forgotten or maybe have never occurred. In a few instances, very few, a previously existing prominence in the upper part of the abdomen has been noticed to flatten out and the patient has been conscious of a sensation as of fluid flowing internally.

#### *Symptoms.*

There is a long latent period without complaints from the patient, but as the cysts in the course of years grow large enough to cause sufficient pressure on neighbouring parts, so arise symptoms, varying according to the location of the cysts, their number, size, pedunculation, infection, and so on. The symptoms are those of pain and of disturbed function, for example, gastric, intestinal, renal, bladder and ureteral interference, venous engorgement *et cetera*. They are just the symptoms that one would expect, and the reader can himself fill in the details. Hydatid cachexia may be present in advanced cases.

#### *Clinical and Laboratory Signs.*

The presence of rounded, tensely cystic abdominal or pelvic lumps, one or many, may be recognized in the usual way by abdominal, rectal or vaginal palpation. Mobility in pedunculated cysts may be obvious. The genuine, but extremely rare, hydatid thrill was noted in two cases only. The recognition by X rays of the position and size of the lumps and of the displacement of stomach, bowel, ureter and so on is sometimes possible.

Calcification is common in old and adolescent cysts and is of course easily demonstrated by X rays.

Pneumoperitoneum, said to be helpful on occasion, was not made use of. Personally I have never liked the idea of employing this somewhat risky procedure. Laboratory findings in these cases, where recorded, particularly the results of the complement fixation and Casoni skin tests, were usually positive.

#### *Complications.*

Various complications are recorded, due possibly to inflammatory adhesions to neighbouring parts, to infection through an eroded bile duct, to suppuration, to perforation and escape into adjacent hollow organs, for example, bladder, uterus, vagina, rectum, colon *et cetera*. One patient, a male, aged thirty-five years (number 662), actually coughed up, vomited, urinated and defaecated hydatid material.

Acute manifestations due to twisting and strangulation of a pedunculated cyst of omentum or mesentery have been noted in some cases. Tertiary cysts may result from the rupture of abdominal secondary cysts.

Choleperitoneum, a rare and very interesting complication, is brought about by the leakage of bile in addition to the hydatid material from a ruptured or fissured liver cyst. This so-called hydatid choleperitoneum is characterized by the formation of a thickened adventitious coating or false membrane over the peritoneum, enclosing vast numbers of daughter cysts and sometimes leading to colossal distension of the abdomen. Two such

records are in the Registry—number 341, in a patient aged thirty-nine years, and number 1283, in a patient aged thirty-four years (also chyloperitoneum). Diagnosis is rarely made before puncture or operation.

#### *Diagnostic Errors.*

Diagnosis mistakes are common, as the writer knows from his own personal experience. Such pre-operative labels as hydronephrosis, ovarian and other non-parasitic cysts, ascites, tuberculous peritonitis, appendicitis, uterine fibroids, carcinoma or sarcoma and even pregnancy have been falsified by the findings at abdominal operation and in not a few by post-mortem examination.

Amongst other diagnostic errors noted in the records are the following. In four cases an acute appendicitis syndrome was found on operation to result from the presence of hydatid cysts in the right side of the lower part of the abdomen; one of them showed oncoming strangulation from a twisted pedicle. In five cases ovarian cysts or uterine fibroids were the pre-operative diagnosis. Two patients suffering from urinary retention were labelled and at first treated as though they were suffering from enlargement of the prostate. One case diagnosed as inguinal hernia proved on operation to be a hydatid cyst working its way down from the peritoneal cavity. Hydatid mimicry may deceive even the elect among clinicians.

#### PROGNOSIS.

The prognosis really is not so bad as it is painted. It is no doubt true that the ultimate mortality is high, but the great majority of patients live on for years, and fairly comfortably too, surviving operation after operation, and may even reach old age. The Registry contains records of patients who have been under the hands of operating surgeons twenty times or more and still come up smiling. One patient survived twenty-eight operations, but died at the twenty-ninth.

#### MORTALITY.

Deaths are noted in 36 of the 228 cases, that is, approximately 16%—an under-estimate of course of the mortality rate, for no doubt many more

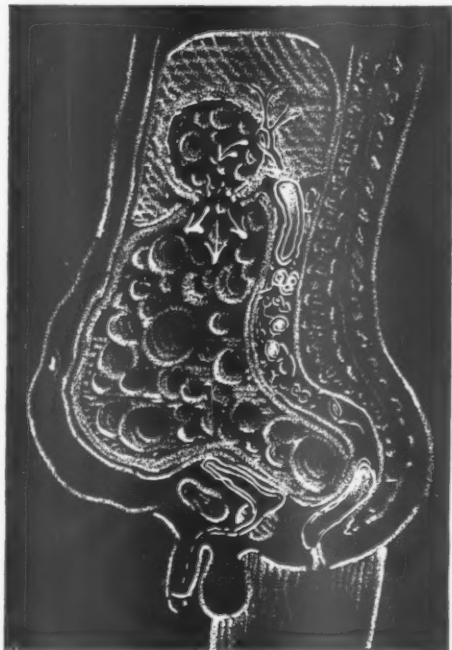


FIGURE VII. Hydatid choleperitoneum. A rare complication of the condition shown in Figures III and IV, due to leakage of bile as well as hydatid elements into the peritoneal cavity. Note the thick membrane of encystment and the backward crowding of abdominal viscera.

of these patients will ultimately fall victims to their hydatid malady and its complications.

Analysing the recorded deaths, one finds the following conditions attributed to these cases:

- 12 cases of long continued suppuration, sepsis, toxæmia, exhaustion.
- 6 cases of fistula producing exhaustion (external faecal, 2; internal into bowel, 2; bronchial, 1; bladder, 1).
- 6 cases of hæmorrhage (profuse hæmatemesis, 3; profuse from bowel, 1; post-operative in jaundiced patients, 2).
- 3 cases of intestinal obstruction.
- 2 cases of jaundice and exhaustion.
- 2 cases of suppurative cholangitis.
- 2 cases of anaphylactic shock.
- 1 case of pulmonary invasion and suppuration.
- 1 case of subphrenic suppuration.
- 1 case of burst abdomen, post-operative.

—  
36  
—

When only one or two cysts are present the prognosis is not at all bad, provided of course that operation is undertaken before the onset of septic or perforation complications. Sepsis, indeed, may be regarded as the chief danger.

A small proportion of cysts actually undergo spontaneous obsolescence and persist merely as an innocuous rounded mass of crumpled hydatid membrane and debris enclosed in a dense fibrous and maybe partly calcified capsule.

Unexpected findings of this kind have been recorded in the autopsy reports of most large hospitals, particularly, of course, those of hydatid countries.

#### TREATMENT.

##### *Non-Operative Treatment.*

Many painstaking efforts to kill or scotch hydatid cysts in the human body by means of drugs, such as kamala, male fern, arsenobenzol, tartar emetic, trypaflavine, lipiodol, serum, vaccines, antigens, antibodies, diathermy, X rays and so forth, have been made, but all have ended in failure. The alluring vision has proved a mirage. A few immunizing experiments have also been made on the lower animals and some slight success is claimed. So far, however, the results cannot be considered as conclusive.

When one is faced with an acute abdominal emergency that turns out to be a case of ruptured hydatid cyst with peritoneal contamination, it is advisable as a preventive of secondary cyst formation to pay particular attention to the abdominal toilet, swabbing the abdominal and pelvic recesses with meticulous care and gentleness, using swabs moistened with ether for choice as a parasiticide (Dévé). Do not use formalin solution, even a weak one, in contact with the delicate peritoneum. It is far too irritating and may also cause crippling adhesions.

*Formolage*, with the use of a 2% solution as recommended by Dévé, is a useful preliminary in univesicular cysts for the purpose of lessening the risk of wound and peritoneal contamination at a primary operation. Stronger solutions recommended by some surgeons are really not necessary and may be harmful by their irritating and possibly necrosing effects. Multivesicular

cysts are not suitable for the ordinary aspiration technique of *formolage*. They have first to be evacuated by incision or large bore aspiration (Finochietto) and then the formalin solution is swabbed cautiously over the interior.

Grave anaphylaxis following hydatid operations, especially when a general anæsthetic is employed, is very rare and most surgeons take no particular precautions to prevent it, claiming that it is not worth bothering about; but two deaths from anaphylaxis—number 944, a patient aged seven years, and number 1391, a patient aged thirty-six years—are included in this tabulation of 228 cases of peritoneal hydatids. If anaphylactic symptoms do arise or if undue sensibility to hydatid toxins is feared because of the patient's history or because of a fierce Casoni reaction, then a subcutaneous or intravenous injection of one cubic centimetre of a 1 in 1,000 solution of adrenaline should be administered at the appropriate time.

#### *Operative Treatment.*

Do not do too much at one sitting. Be guided by the ease with which the cysts can be dealt with and by the general condition of the patient.

The pedunculated or near pedunculated and most of the omental cysts are best dealt with by complete excision, including their adventitia.

The sessile cysts that are fairly easy to approach should be completely emptied of their contents, preliminary and cautious *formolage* being used. Do not attempt to dissect away the adventitia in these cases. You will only land yourself in hæmorrhagic and other difficulties and inflict needless traumatism, and perhaps produce bowel or bladder fistula and so on. Simply evacuate the contents cleanly and thoroughly and oversee the opening in the cyst wall to lessen the risk of subsequent bowel adhesion.

Other cysts inviting attention, but awkwardly situated, may be dealt with, as suggested by Dévé, by *formolage* alone, and some, perhaps indeed most, should be left for another day.

Drainage is called for only in dealing with suppurating cysts. The first operation should include as far as is practicable an abdominal exploration in order not only to get an idea of the number and location of secondary cysts to be dealt with, but also to discover the site and condition of the original primary cyst in liver, spleen or elsewhere. Let therefore your first incision be large enough to permit easily the introduction of the whole questing hand. Be gentle in manipulation and beware of bursting thin-walled cysts and fragile bulgings.

The original sinner, the primary cyst, usually of the liver, that burst or leaked, may have shrivelled out of recognition and may therefore require no treatment. On the other hand, it may have developed within degenerated walls a numerous and aggressive family of daughters which calls for evacuation. When a cyst shows evidence of sepsis and suppuration, it is better dealt with at the end and not at the beginning of the operation. When one is faced with an awkwardly located cyst the following advice may be helpful:

Remove it whole or leave it dead.  
Don't scotch it merely in its bed.

#### SPECIAL REFERENCE TO PELVIC CYSTS.

In the female, pelvic cysts usually come under the care of the gynaecologist, and it is a common error to regard them as primary cysts of the pelvis.

Such cysts do occur, but they are extremely rare. The pelvic cysts usually met with are secondary to a ruptured or leaking cyst of the liver, or conceivably of the spleen, but their secondary origin more often than not is unrecognized even after operation.

The history given by the patient may be devoid of any reference to past symptoms suggestive of leakage from a primary cyst. Cysts located in the pelvis may, as in other regions, be latent for many years as far as symptoms are concerned. Much depends upon what pressure or erosion they exert on neighbouring structures. Obviously infection and abscess formation will bring about painful and troublesome complications and obviously, too, pregnancy may be seriously interfered with, necessitating operation during, prior to or after confinement, according to circumstances. Caesarean section was performed in three of the recorded cases, all successfully (number 393, in a patient aged twenty years, number 277, in a patient aged forty-eight years, and number 1107, in a patient aged thirty-one years). Quite a number of cases are on record in our own and foreign countries in which, as the result of deep and burrowing invasion associated with suppuration and necrosis, pelvic cysts have evacuated themselves by bursting and discharging externally by way of uterus or vagina, bladder or rectum.

Amongst surgical curiosities to be found in hydatid literature are instances of cysts in the prostate gland, testis and hernial sacs.

As a general rule, pelvic cysts should be operated on without undue delay and by the abdominal route, which obviously has many advantages over a perineal, vaginal or rectal approach. Exceptional cysts, especially the suppurative ones, may, however, be best evacuated from below.

#### RETROPERITONEAL BURROWING CYSTS.

A chain or procession of exogenously multiplying cysts is sometimes seen tracking along the abdominal retroperitoneal tissues and, aided by gravity, burrowing downwards along the fascia of the muscular plane (psoas and iliacus) and large blood vessels and extending into the pelvis, under Poupart's ligament, and even into Scarpa's triangle and the upper part of the thigh. There are rare cases of this kind in which the migration is of spinal origin. Painful pressure symptoms and possibly inflammatory complications may be present. Needless to say, the prognosis in such cases is extremely bad, but repeated operative attack may be helpful or even curative.

#### SUMMARY.

The main points in this study of hydatid cysts of the peritoneal cavity are:

1. The cysts, usually multiple, but sometimes single, are with rare exceptions secondary and brought about by leakage from a primary cyst of the liver many years previously. Such leakage more often than not has been insidious or completely forgotten by the patient. Cases are frequently met with; 228 are noted among 1,455 hydatid records in the Hydatid Registry at the end of the year 1939.
2. Errors in diagnosis are common.
3. Prognosis is not so bad as it is painted. The prospects of their reaching old age are remote, but most patients have a fairly long and useful life.
4. Surgical treatment is sooner or later called for and operations may have to be repeated again and again.



## ACKNOWLEDGEMENTS AND BIBLIOGRAPHICAL REFERENCES.

References and acknowledgements could easily be voluminous, too voluminous indeed for a paper of this kind.

To all his colleagues who have so kindly helped to provide the material for this analysis by sending in their hydatid records, the writer expresses his sincere thanks.

The foundations of modern knowledge of secondary echinococcosis were well and truly laid nearly forty years ago by Félix Dévé, of ill-fated Rouen. Out of his publications, of which there are literally hundreds, the writer selects: "*Vue d'ensemble sur l'échinococcose secondaire des sereuses*", *L'Algérie Médicale*, May, 1939; "*Traitement des kystes hydatiques multiples de l'abdomen*", *Congrès Yougo-slave de Chirurgie*, Split, October 5 to 8, 1930; "*Secondary Echinococcus*", *The Lancet*, November 8, 1919.

Harold R. Dew, of Sydney, by masterly research, corroborated and amplified the conclusions expounded by Dévé. His book, "*Hydatid Disease*" (Australasian Medical Publishing Company Limited, Sydney, 1928), is a mine of information supplemented by full historical and bibliographical references.

From Argentina and Uruguay there have come many important contributions on the subject of peritoneal cysts. A particularly good one is Velarde Perez Fontana's monograph, "*Quistes hidatídicos rotos in el peritoneo y las membranas consecutivas de enquistamiento*" (Montevideo, 1932).

The German textbook "*Die Echinokokkenkrankheit*" (Band 40 of *Neue Deutsche Chirurgie*, Ferdinand Enke, Stuttgart, 1928) is cram full of detail on this and other aspects of hydatid disease.

The book "*Echinococcosis*" by Lozano, of Saragossa (Bailly-Baillière, Madrid, 1931), is interesting because this author still holds the view that most of the cases of multiple abdominal cysts arise, not from leakage of a primary cyst, but from direct burrowing of numbers of hexacanth embryos through the intestinal walls, after whole proglottides have been swallowed.

The Australian books published many years ago by Davies Thomas and Graham, of Sydney, and by Lendon, of Adelaide, contain much interesting clinical matter on multiple abdominal cysts, but from the pathogenic point of view they are now somewhat out of date. It is, however, interesting to note that Graham was the first to mention the occurrence of the so-called pseudo-tuberculous granules.

From time to time Barnett has published papers bearing on the subject of peritoneal invasion by hydatid cysts, amongst others: "*Formalin in Hydatid Cyst Operations*", *New Zealand Medical Journal*, February, 1935; "*Colossal Hydatid Cysts*", *The Medical Journal of Australia*, December 24, 1927.

## THE NEURALGIAS OF THE FACE.<sup>1</sup>

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Melbourne.

My purpose in addressing you on the subject of neuralgia of the face is to present some experiences in the treatment of that painful condition, not associated with recognizable disease. Many of you must come across cases which do not fit into any of the known categories in which pain in the face is the main complaint. It is obvious that in all cases of pain in the areas of distribution of the cranial or cervical nerves, a thorough investigation of the common sources of such pain is imperative. A carious tooth, exposed dentine, a suppurating antrum, a frontal sinus, a malignant tongue or antrum, or even a suppurating mastoid spreading into the tip of the petrous temporal may be found to account for the pain. Within the cranial cavity a number of conditions may involve the fifth nerve and give rise to symptoms of neuralgia of that distribution. The association with headache may lead one to suspect an intracranial neoplasm or other space-occupying lesion, or perhaps the patient may be a victim of migraine.

If we assume that a careful search has been made for causes of facial pain, there yet remain a number of patients whose symptoms are not adequately explained by any local inflammation or neoplasm. It is of these that I wish to speak; at the same time, a few patients with well-defined causes of pain will be mentioned in contrast. One hundred and two cases of facial neuralgia have been in patients under my personal care during the past ten years, and may be classified as shown in Table I.

TABLE I.  
*Classification of Cases of Severe Facial or Head Pain.*

Syndrome.	Number of Cases.
Paroxysmal trigeminal neuralgia ( <i>tic douloureux</i> ) ..	64
Chronic constant pain <i>et cetera</i> , associated with persisting dental, antral disease ..	21
Intracranial causes such as neoplasms, arachnoiditis, old fractures ..	11
Ciliary neuralgia ..	3
Post-herpetic neuralgia ..	2
Psychalgia (so-called) ..	1
Total ..	102

A description of typical cases is probably a better method of bringing out points than is the detailing of statistics of the series. Suffice it to say

<sup>1</sup> Accepted for publication on December 20, 1938.

that of the trigeminal neuralgias (tics) the greatest numbers occurred in the seventh and eighth decades of life, that is, 75% were elderly patients (Table II).

TABLE II.  
*Trigeminal Neuralgia in Relation to Age.*

Decade of Life.					Number of Cases.
Fourth	..	..	..	..	3
Fifth	..	..	..	..	11
Sixth	..	..	..	..	6
Seventh	..	..	..	..	22
Eighth	..	..	..	..	13
Ninth	..	..	..	..	7
Tenth	..	..	..	..	2

The pathology of paroxysmal trigeminal neuralgia is unknown. Multiple sclerosis is occasionally a complication. Dandy<sup>(1)</sup> thinks that arterial loops in the subarachnoid space, in direct contact with the naked sensory root, may cause the pain in many cases. (In one of my cases this was undoubtedly the cause, and the condition was dealt with by Dandy's method.) Wilfred Harris<sup>(2)</sup> favours the theory of sepsis of teeth or antra, that is, disease about the nerve endings. Though the latter view may be correct, patients who have had obvious dental or antral sepsis present a different kind of pain not always readily amenable to cure by interruption of the fifth nerve (see below). Vasomotor abnormalities<sup>(3)</sup> have been evoked to explain the paroxysmal nature of the pain.

One of my oldest patients was a lady of eighty-nine years, who had suffered for twenty-five years from severe pain in the right maxillary region. The pain came on in paroxysms, causing terrific agony in the upper jaw and radiating to the forehead and side of the nose. Lachrymation and salivation accompanied the pain, which lasted a few minutes and then disappeared until the next attack. The earlier attacks were not frequent, occurring perhaps once a month, and intervals of freedom up to a year would occur. Latterly the attacks were daily in occurrence and she could not go out for fear that cold would initiate an attack. Eating, talking *et cetera* brought on an attack. She had consulted many doctors, who tried various remedies, but without success. She was seen by a surgeon who informed her that she was too old to be operated upon and that she must put up with it. Two years ago I injected her right Gasserian ganglion with 1.5 cubic centimetres of absolute alcohol after local infiltration with "Novocain". Complete freedom from pain and anaesthesia of the whole of the right trigeminal field have persisted. She is hale and hearty at ninety-one, and informed me a few weeks ago that she had had no attacks of pain since the injection. She instils a drop of adrenaline solution into the eye each day and wears goggles when out of doors.

The following is a case of a younger patient showing a response to treatment which has persisted for ten years.

A man, aged forty years, was referred to me by his doctor with the complaint of paroxysmal attacks of pain, commencing in the right side of the palate and in the deeper part of the right nostril. A trigger point was present on the inferior turbinate bone. For several years these attacks, at first occasional, had been recurring at more and more frequent intervals. So severe were the attacks that he could not carry on his business as a commercial traveller. He could not blow his nose without starting an attack. Alcohol injection of the Gasserian ganglion completely relieved the pain, which has not recurred. Anaesthesia persists over the whole fifth nerve field. His doctor informed me this year that he is quite normal.

A third case will illustrate the value of this method when operation had failed.

A lady of seventy-five years had been operated upon twice in Melbourne for *tic douloureux*. The pain was in the maxillary distribution of the fifth nerve on the right side. A decompression opening was present in the right temporal area. There was a little vague anaesthesia of the lower jaw. Gasserian ganglion injection was followed by relief of pain, and anaesthesia was produced over the whole fifth nerve field. For two years she has been quite comfortable. Eye toilet is carried out and goggles are worn for protection.

In the above cases complete destruction of the Gasserian ganglion has been produced. This is not always necessary; and during the past two years I have carried out a number of fractional injections of the ganglion, that is, when the pain has been entirely confined to the lower jaw, the ophthalmic part of the ganglion has been spared. When the ophthalmic portion was involved, as in severe ciliary neuralgias and some of the maxillary group, the mandibular portion has been preserved intact. I cannot promise that this happy issue will occur, but with increasing practice it can be obtained more frequently than before.

For milder attacks of paroxysmal pain in the mandibular area I have performed a local perineural injection either at the mental foramen or at the *foramen ovale*. In these cases all the patients have returned within a year with recurrence of pain, and in all but one instance I have proceeded with ganglion injection.

In four cases I have had to repeat the injection, as a residual area of face recovered sensation and slight pain returned. Gasserian ganglion injection produced complete and persistent relief in 61 of the 64 cases of trigeminal neuralgia and three of paroxysmal ciliary neuralgia of severe grade. The use of trichlorethylene, drugs, external diathermy and vitamin preparations has been omitted. By the time the patient reaches the surgeon, these methods have proved their futility.

Necessarily, there have been some failures. In the first twelve cases in which I carried out injection there were three which were unsuccessful in that I did not produce relief of pain. These patients were subjected to root section of the fifth nerve. Two of these conditions were *tic douloureux*; one was post-herpetic neuralgia. In three other cases in which the patients had been unsuccessfully treated by injections elsewhere, I cut the posterior root. In three cases of neuralgia of the constant type (Sluder's neuralgia) division of the posterior sensory root was performed. The operations were performed by the Adson temporal approach in all but one case, in which I employed the Dandy suboccipital approach. There were three deaths in that early series following operation; one was due to pontine haemorrhage, one was an anaesthetic death, and one death was due to cerebral softening; the patients were all old people. These early experiences indicated that operation is a serious affair in elderly patients suffering from *tic douloureux*. Arteriosclerosis, general debility, cardiac deficiency and other senile changes render these patients poor risks for any operation; hence my enthusiasm for the injection technique. With experience and practice, I consider that the alcohol injection treatment of *tic douloureux* is successful in most of the cases and permanent in its results. I entirely agree with Hartel<sup>(4)</sup> and Harris<sup>(5)</sup> that it is a reliable method of treatment in even the most severe cases. For

cases in which it has been unsuccessfully employed I would try it again, and if that failed, would cut the sensory root of the nerve. It must be realized that ganglion injection is a totally different operation from the usually attempted nerve injection; the effects of the latter pass off within six to twelve months.

It is fashionable in some quarters to condemn injection procedures and to insist that root section is the only rational treatment. My experience would indicate that a carefully performed ganglion injection is a safe and reasonably certain method of cure. Operation may be reserved for the few cases in which injection fails.

#### COMPLICATIONS OF GANGLION INJECTION.

The complications of ganglion injection are few and not fatal, provided the procedure is undertaken by one who has studied the minute anatomy of the region involved. Disasters are not unknown, as the following cases illustrate.

I was called to see a moribund patient recently who had had an alcohol injection of the Gasserian ganglion. A general anæsthetic had been employed. The operator had inserted a needle into the base of the skull and then injected some alcohol. The patient died of hæmorrhage into the subarachnoid space.

Another patient consulted me for severe trigeminal neuralgia. She stated that she had had an alcohol injection under a general anæsthetic, but had obtained no relief. Since the injection she had been blind in the eye, deaf in the ear, paralysed in the facial and ocular muscles on the affected side.

Fortunately, I have never encountered such serious complications as these, but they are a constant reminder that the procedure is fraught with risk. Eye complications are the most serious. I have had eight cases in which prolonged after-care of the eye was necessary. Dr. Z. Schwartz has kindly attended most of these patients.

One man lost his eye. He had suffered from intolerable pain for ten years, had had three operations without relief, and requested injection treatment. Injection was carried out in my rooms, contrary to my usual practice. The patient paid no attention to his eye, as it was not painful, but a corneal ulcer developed and it was so far advanced when he was next seen that his oculist removed his eye. His tic has not recurred after eight years.

Four other patients have had ulcers requiring suture of the lids for six months, but all have recovered with very slight scarring of the cornea. The same complication occurs after complete or even partial root section; in one of my cases of root section ulceration necessitated suture of the lids for a time, and I observed several patients in neurological clinics abroad who required similar ocular treatment; it is the risk from an anæsthetic cornea. Whenever the eye is persistently red following injection, I suture the lids for a fortnight and then instruct the patient to instil thrice daily drops containing adrenaline solution and to wear goggles with lateral shields when out of doors. No other complications have occurred except occasional transient diplopia and slight trophic changes in the nose. The patients are so genuinely relieved of their agonizing attacks of pain that they make little of the anæsthesia of the face and cheek and of the tendency to be unaware of the position of food in the mouth on the affected side. Herpes usually appears about the mouth or nose after five days. I have not noted any disability from interference with the motor root of the fifth nerve except in one case in

which neuralgia was bilateral. There were four bilateral cases in my series. In two of them the Gasserian ganglion was injected on one side, and at a later date, when the other side was affected, the mandibular nerve was injected at the *foramen ovale* in one and the maxillary nerve in the other at the pterygo-palatine fossa. One patient had an avulsion of the inferior dental nerve on one side and ganglion injection in the other.

The case illustrating the loss of the motor root was of interest.

The patient had his left fifth nerve divided fifteen years ago. Unfortunately he lost his left eye and all his left masticator muscles. However, he has had no further pain on that side. Ten years ago tic began on the other side of the face in the maxillary area. Local injections were performed many times, and he was about to go to the Mayo Clinic; but owing to the severity of the pain, he called for some temporary relief. I injected the Gasserian ganglion very slowly over three days with tiny amounts of alcohol, finally producing anaesthesia of the maxillo-mandibular area, but sparing the cornea in its greater part. The last injection caused sudden drop of the jaw, as he had lost all muscle control of the mandible. Wearing a support for the jaw for the past six months, he has carried on and can now eat quite well and wear his teeth. He has almost completely recovered control of the jaw, and fortunately the pain has not reappeared.

#### THE INJECTION TECHNIQUE OF HARTEL.

I employ the Hartel method. The face lateral to the angle of the mouth is infiltrated with 2% "Novocain" solution. A long chrome steel needle is introduced and carefully guided to the *foramen ovale*; a finger inside the mouth will coax it past the pterygoid process. "Novocain" is then injected in quantity into the space outside the *foramen ovale* and the needle is carefully pushed in. The patient then complains of pain in the ear, usually owing to fibres of the auriculo-temporal nerve being involved. The planes of direction are marked on the face with iodine or skin pencil. A vertical line from the outer canthus and an oblique line from the condyle of the mandible to the point of injection give the general direction of the *foramen ovale*. A good tip is to insert the needle rather higher than the *foramen ovale*, so that it impinges on the flat surface of the infratemporal part of the great wing of the sphenoid. Hard bone can be detected there, and then the needle is withdrawn a little and reinserted at a slightly more horizontal angle until it enters the inner portion of the foramen. If the Eustachian tube is punctured, the patient will remark that something is running down the throat. The needle is allowed to rest just inside the foramen, and then the plunger of a small syringe is withdrawn in order to ensure that blood or cerebro-spinal fluid is not tapped. A little "Novocain" is then injected and anaesthesia over the lower lip should be produced. By carefully injecting against resistance, it is noted that the needle point is in the nerve and not in the subarachnoid space. A drop of absolute alcohol is then injected and the needle is inserted slightly further; then more alcohol is injected drop by drop, a tiny syringe being used and only about four or five minims being taken at a time into the barrel. The patient will complain of pain over the affected area, that is, he will have a final attack, and the slow instillation of alcohol is continued until pain stops and anaesthesia over that area is complete. Not more than ten to fifteen minims of alcohol should have been injected. The needle is left in place and strapped onto the face. The patient is seen four hours later, and if the anaesthesia has not faded, the needle is withdrawn. If some sensation has returned, the alcohol injection is resumed. If the cornea is anaesthetic and red, suture of



the eyelids with two points of fine black silk suffices. The patient is detained for three days in the hospital bed in which the injection is performed, and then is given careful instructions regarding the eye toilet and allowed to go home.

The needles are six inches long, and a series with short and long bevels are on hand. If the short bevelled needle does not enter easily, a fine needle with long bevel is tried.

#### OPERATIVE TREATMENT.

Of operative treatment I cannot speak with authority, but my limited experience would indicate that the temporal approach is safe, although the posterior approach is a surer method for section of the posterior root when previous injections have been made. The sitting position is not advisable. The blood pressure falls, and, as Davidoff<sup>(6)</sup> has shown, a definite risk of brain softening is present. The posterior operation may be performed under local anaesthesia, and a good view of the cerebello-pontine angle can be obtained. In the one case in which I employed this method, arachnoiditis of the posterior fossa, involving the fifth, seventh and eighth nerves, was adequately dealt with, and the knuckle of an artery which apparently caused the fifth nerve pain was dissected away and tucked into a sulcus of the cerebellum. The electrocoagulation method of Kirschner<sup>(7)</sup> appears to be only a more complicated refinement of the alcohol injection procedure.

#### PERSISTENT PAIN ASSOCIATED WITH PREVIOUS DENTAL, ANTRAL OR FRONTAL SINUS DISEASE.

In the group of cases characterized by persistent pain associated with previous dental, antral or frontal sinus disease a number of patients referred to me by the appropriate specialists were subjected to alcohol injection of the Gasserian ganglion, and three of them were subjected to section of the sensory root of the fifth nerve. Despite this radical treatment, cure was incomplete. The following case is typical.

Miss M. suffered from antral disease and had been operated on many times. Persistent facial pain associated with lower half headache, radiating to the post-auricular region, had induced her to seek radical treatment. Alcohol injection of the Gasserian ganglion producing complete anaesthesia of the half face did not relieve the pain. Stripping the common carotid artery of its sympathetic fibres and section of cervical cutaneous nerves produced no effect.

The patient still describes her agonies (now present for ten years), but apparently "enjoys" bad health! Is she a victim of excessive surgical zeal?

Another patient, a male, had persistent pain over the left orbit. A number of operations had been performed by an aural surgeon, including radical operation on the left frontal sinus. The pain was persistent and the man was the picture of misery. I was asked to inject his fifth nerve. This proved futile, so reluctantly I divided the sensory root of the fifth nerve, producing total anaesthesia of the half face. Only partial relief was obtained. The eye was troublesome and lid suture for six months was necessary. Two years later another aural surgeon discovered a small inflammatory focus in the remains of the frontal sinus. This was cleared up, whereupon the pain ceased.

This case is of interest, as it indicates that the fifth nerve is not the sole sensory supply of the frontal sinus.

I was called to treat a similar patient recently, but, profiting by the previous experience, I advised the aurist to open up the frontal sinus first and if no pathological change was present (which he insisted was the case), I would avulse the supraorbital nerve. At operation a small collection of pus was found in the old sinus.

In yet another case I must confess failure.

A lady who suffered from Sluder's neuralgia, persistent pain in the left frontal and maxillary area, was submitted to section of the fifth nerve and resection of the superior cervical sympathetic ganglion. No relief was obtained.

In all these cases the sphenopalatine ganglion was cocaineized by the aurist without result, and in one case I actually removed the ganglion through the posterior wall of the maxillary antrum. No improvement resulted. One wonders whether the pain is transmitted by the facial nerve. It is certainly not affected by sympathetic nerve section, as Helson's<sup>(5)</sup> theory suggests it should be. The facial nerve has many connexions with other nerves, and it is a primitive nerve subserving cranial visceral function. Like the vagus, it transmits many types of impulse both ways.

These early experiences have induced me to regard with suspicion constant facial pain following antral disease, and if consultation with two otorhinologists is inconclusive, I usually prescribe tonics, a holiday, "Benzedrine" inhalation, bromides and vitamin B. Great improvement occurs under this regimen, but local persistence of disease must be suspected in cases which do not clear up. In two such cases I have found that local infiltration of the maxillary nerve at the sphenomaxillary fissure has been successful.

In dental cases the outlook is not so bad.

A patient complaining of constant pain in the lower jaw following the extraction of a deformed root of a second molar, was treated by injection of the mandibular nerve at the *foramen ovale*. Complete relief was obtained.

In another such case of persistent pain for two years, caused by the laceration of the inferior dental nerve, the patient was treated by trephining the angle of the mandible through a small curved incision and resecting the inferior alveolar nerve in its canal and plugging the canal with wax. This was quite successful.

An interesting case of petrositis following a right mastoid abscess was brought under my notice.

Severe pain in the right maxillary area which had not been relieved by extractions of some suspected teeth, led the patient's surgeon to suspect that the petrous temporal was affected. Radiological examination revealed a pneumatized petrous tip. There was no ocular palsy. Operation by the Adson approach to the Gasserian ganglion—elevation of the dura—disclosed an abscess in the petrous bone immediately beneath the ganglion.

To sum up: Constant pain in the face and jaws, associated with previous dental, antral or frontal sinus infection or trauma, is quite distinct from the paroxysmal terrific pain of *tic douloureux*. In the former there is a suspected cause for the pain; the pain is not intolerable, but may be severe; it is constant; it resembles the pain of amputation stump neuralgia. It is best treated by local measures, and if nerve pathways are interrupted, the site of section should be close to the affected part. Relief is not always complete, especially if undiscovered foci of disease, such as dental abscess or necrosed bone, persists.

*Tic douloureux*, on the other hand, is characterized by its remissions, paroxysmal attacks, overflow phenomena (salivation, lachrymation), absence of any obvious lesion in the fifth nerve field, absence of any obvious neurological lesion. A trigger point is often detected. It is best treated by central attack on the nerve, the Gasserian ganglion or the posterior root, and relief is certain. These conclusions are also reported by Craig,<sup>(9)</sup> of the Mayo Clinic.

#### INTRACRANIAL CAUSES OF PAIN: NEOPLASMS, ARACHNOIDITIS, FRACTURES.

Other causes of fifth nerve pain should be noted. Old fractures of the skull base may involve the mandibular or maxillary nerve. Constant aching pain occurs and is difficult to relieve except by sensory root section. In one case of well-marked *tabes dorsalis*, *tic douloureux* was an incidental condition.

This patient, who had suffered for fifteen years, had been under medical treatment, but had been told that he could not be relieved as he had syphilis. His attacks were typical of paroxysmal *tic douloureux*. Alcohol injection of the Gasserian ganglion two years ago was followed by complete freedom from pain.

Another syphilitic patient presented himself, manifesting all the signs of basal meningeal syphilis. Ocular palsies and patchy anæsthesia of the fifth nerve field were present. His pain was constant, and I did not treat him by injection. A few months later he developed a gumma of the face which might have been attributed to the alcohol had it been employed.

Among other cases in which a lesion was discovered, I mention the case of a lady who suffered from severe supraorbital pain and headache.

Investigation revealed papilledema and homonymous hemianopia. A large meningioma was removed from the upper surface of the *tentorium cerebelli*. Pressure on the *nervus tentorii* caused the pain.

#### CILIARY NEURALGIA.

The group of conditions known as ciliary neuralgia is of interest to oculists and physicians. Of three patients suffering from this condition whom I have injected, all obtained good results. A typical case is as follows.

Mrs. B., referred by a gynaecologist, suffered from severe pain over the right eye. There was some relation of the pain to the menses, but all attempts at relief by endocrine treatment had failed. Medical measures were equally unsuccessful. The pain was especially severe in the eyeball and it was paroxysmal in type. Fractional injection of the upper part of the Gasserian ganglion relieved the pain. Eyelid suture was necessary.

Other cases of severe ophthalmic pain associated with ocular paralysis are seen in association with aneurysms of the arteries of the circle of Willis. Though this condition does not come within the scope of this paper, a brief résumé of such a case may be of interest.

Mr. A., aged twenty-eight years, suffered for many years from supraorbital pain and headache. During the last six months this headache was almost unbearable and he had diplopia at times. He was investigated neurologically and nothing abnormal was noted, except an inequality in the pupils, the left being dilated. Arteriography of the left internal carotid artery in which "Thorotrast" was used, disclosed a small aneurysm of the internal carotid artery at its bifurcation. Ligature of the internal carotid in continuity completely cured the headache and abolished the pain. Some diplopia persisted for a time, but the patient is now well.

The morphological distinction between the ophthalmic portion of the fifth nerve and the maxillo-mandibular part (compare the *nervus profundus* in the lamprey) and the long cervical central connexions of the ophthalmic

fibres suggest that pain of the first division should be regarded as distinct from pain in the other portion of the nerve. Dandy's posterior approach ensures a more certain section of all the ophthalmic root fibres. On the other hand, I have had several cases of severe tic of the first division and also one case of post-herpetic pain completely relieved by ganglion injection. The same applies to ciliary neuralgia.

#### PSYCHALGIA.

The term psychalgia has been applied to a condition in which pain is the outstanding complaint and yet no cause has been discovered; it is not cured by root section of the appropriate nerve. I doubt the existence of this condition. The case of a doctor illustrates the condition.

Pain over the supraorbital area, temporarily relieved by supraorbital nerve avulsion, was then treated by fifth nerve root section. Three attempts were made by different surgeons to relieve the pain. Despite anaesthesia over the face, he complained of pain. Alcohol injection was requested, and of course it proved futile. A further operation by another surgeon was equally ineffective.

One cannot help thinking that this patient retains a few fibres of the fifth nerve which still conduct painful impulses. Section of the nerve at the pons by the Dandy approach might cure him.

#### CHRONIC FACIAL NEURALGIA.

There is a definite condition in young women described by Harris as chronic facial neuralgia. The patient, usually a healthy looking young woman, complains at great length and in detail of a constant agonizing pain in the jaw (usually the upper). I have seen the same condition in a young man who smiled as he related the agonies that he suffered, his sleepless nights *et cetera*. Examination reveals nothing definite and the pain does not conform to a known area of radiation. These patients are best handled by psychiatrists.

Finally, there are a few patients for whom comfort and relief in their few remaining months may be obtained by interruption of nerve pathways. I refer to malignant disease of the mouth and face. The intractable pain caused by a lingual carcinoma can sometimes be relieved by alcohol injection of the mandibular nerve. In other cases, after radium treatment has been effectively employed and the malignant growth destroyed, the patient may suffer torture from a painful scar or from persisting neuritis of the inferior dental or glosso-pharyngeal and lingual nerves. Section of these nerves under local anaesthesia is easily performed and will ensure the relief which the sufferer deserves. There is a tendency in some quarters to disregard the pain when the malignant lesion appears to be cleared up, but I know many surgeons who condemn the use of radium because of the dreadful after-pain. Employ the radical element by all means, but heed the groans of the suffering patient! The human element tends to be submerged in a maze of mathematical formulæ.

Perhaps the history of the Bloody Assizes would be a different story had the unfortunate and infamous Jeffreys obtained relief from his facial neuralgia and his bladder stones. In these days of mechanism and laboratory investigation, it is wise for us to remember that the patient calls the doctor usually to relieve pain, and when such relief is unobtainable by other means, interruption of nerve pathways is a merciful and also a scientific form of treatment.

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## THE TREATMENT OF RECENT FRACTURES OF THE NECK OF THE FEMUR BY SUBTROCHANTERIC OSTEOTOMY.<sup>1,2</sup>

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IN considering the treatment of fractured neck of the femur, one is forced to pay tribute to the excellence of the results sometimes obtained by the use of the three-flanged nail. No one denies that, in a successful case, nothing could be better than the results obtained by its use. The operation is apparently not difficult, and the convalescence of the patient is easy and comfortable, but the excellence of the results sometimes obtained in skilled hands should blind us neither to its failures nor to the possibilities of other methods of treatment in certain cases.

### THE THREE-FLANGED NAIL OPERATION.

The three-flanged nail operation is not as easy as it seems and calls for a considerable amount of skill and judgement. There is no doubt that some people seem to have a greater facility for introducing pins than others, and, generally speaking, the man who is doing numbers of these operations does them with less difficulty and greater certainty than does the "occasional pinner". There is no doubt that a well placed pin is much more likely to give a good result than a badly placed one; in fact, to get union with a badly placed pin is almost a rarity. So much is this so that innumerable mechanical gadgets have been invented to aid the surgeon, but their very multiplicity suggests that none is really adequate.

There are still some advocates of the open operation, but this has been practically abandoned in England and America. I think that the pinning operation loses much of its value if an extensive dissection has to be done, and it is agreed that dissection is followed by a greater number of cases of aseptic necrosis. But the "blind operation" demands adequate X-ray equipment and technicians, and should be done only when conditions are favourable.

### CLASSIFICATION OF FRACTURES OF THE NECK OF THE FEMUR.

The usual classification of fractures of the neck of the femur is as follows:

1. Subcapital fracture.
2. Transcervical fracture.
3. Basal fracture:
  - (a) Intertrochanteric, along the intertrochanteric line.
  - (b) Pertrochanteric, more laterally placed.
4. The undisplaced or impacted fracture.

<sup>1</sup> Accepted for publication on April 15, 1939.

<sup>2</sup> In *The British Medical Journal* of March 11, 1939, page 525, T. P. McMurray quotes twelve consecutive cases of recent fracture treated by osteotomy, in all of which union has occurred.



Of these, the first two are the only ones which offer any real difficulty as far as union is concerned. The basal and undisplaced fractures readily unite by conservative methods. They also unite equally well if pinned, and therefore a high percentage of these cases in anyone's statistics of the operation may cloud the issue as to its value in the other two types.

The operation may be said to fail for two main reasons: (a) more or less immediate, (b) delayed.

1. A failure to induce union of the fracture may be due to: (a) Inadequate reduction and poorly placed pin. (b) The working out of the pin before union has occurred. (c) The cutting of the pin through the head soon after weight bearing has commenced. (d) Refracture when, after apparent bony union, the pin has been removed, with almost immediate sagging at the fracture line. (e) Infection, which does sometimes occur.

2. The subsequent development of a painful arthritis in the hip, sometimes apparently due to the so-called "aseptic necrosis".

It was after seeing two or three cases of pinning in which union had failed to occur that I began to have my doubts as to the method. Although the successful case is dramatic and the convalescence easy, yet the unsuccessful case goes to the other extreme. It is pathetic to see people who have been well and comfortable, and who have started to walk satisfactorily, begin to complain of pain; their gait becomes slower and their steps become shorter, two sticks are required, and finally it is almost impossible to walk because of the pain. The patient persists in spite of the pain, and finally it may be nine to twelve months before he agrees to something else being done, or the pin is removed and he refuses further treatment. If he will submit to further treatment, an osteotomy will give a satisfactory hip, but it will require another three to four months' treatment, and altogether it may be as long as eighteen months before he is comfortably on his feet again.

To a wage-earner the loss of a year may be an absolute calamity, and in older people a year's unnecessary pain and the necessity for two operations are certainly to be avoided if possible.

The late development of a painful arthritic hip is also a serious thing. There may be a latent painless period of some years, and this should make one chary of accepting figures based on cases in which operation has been too recently performed, and some of the earlier figures published were undoubtedly too optimistic. These patients also usually have to submit to another operation before they become comfortable.

I had one unusual case which became complicated by aseptic necrosis and a periarticular calcification ending with a spontaneous arthrodesis.

This patient, a woman of forty-three years, had a pin inserted by the open method. Four months later the pin was removed because it was already coming out, and she subsequently developed a very painful hip which remained painful for eighteen months. By this time it had become fixed and motionless, but the pain had disappeared.

It might be argued that the results of the use of the pin are so good that the small percentage of failures do not justify any change in the method. But are they so good?

Johannson, in 139 traced cases in which operation was performed, claims only 13 unsatisfactory results—equivalent to 10%. Watson Jones claims about 90% satisfactory results, but admits that he is getting worried about the number of delayed bad results that are occurring. Britain reports 17.4%

of failures in 46 cases. Lloyd reported that the bad results were 40% at first, but later 20%.

These results are a vast improvement on the other methods of treatment, but they are the results obtained by experts, and are probably the best that can be obtained. I do not believe they represent the results of average surgeons.

My own series, which I admit is small, consists of nine cases; three operations were done by myself and six by the consultant orthopaedic surgeon at the hospital in which I worked in London. Among the nine cases there was one death; there were five unsatisfactory cases, four cases of non-union and one stiff hip. I have since investigated the results obtained at the Adelaide Hospital, and they are very little, if any, better.

I am prepared to grant that the results are far from good, that some of the failures can certainly be attributed to faulty technique. But is this sufficient excuse? Surely with such a high percentage of failures it is permissible to criticize the method as well as the operator.

#### PLEA FOR SUBTROCHANTERIC OSTEOTOMY.

I wish, therefore, to make a plea for an operation which, although less spectacular than the pin, suggests that it will give more generally satisfactory results in the hands of most surgeons. By satisfactory result I mean a stable, painless joint with a useful range of movement. The operation to which I refer is that of subtrochanteric osteotomy. This procedure has been recognized for some few years as an eminently satisfactory method of treating ununited fractures of the neck of the femur, and recently it has been suggested that it is the sanest way of treating many of the recent fractures as well. The operation probably materially increases the chances of union, because the tendency is for rotation of the upper fragment of the shaft to occur, and with it the head of the bone. This converts the line of fracture from the more or less horizontal to the more or less transverse and in this position the direction of the muscular pull keeps the fragments close together. The beauty of the whole procedure, however, is that should union not occur, the patient is still assured of a satisfactory hip. If treatment by the Smith-Petersen pin or Whitman plaster fails to give union, a further operation is the only alternative to leaving the patient in a crippled state. Also, it is probable that a painful arthritic hip will never be a complication of this method of treatment, because in those cases in which the head is so badly damaged that aseptic necrosis is likely to occur, union is unlikely to take place, but still a stable, movable hip is obtained.

The operation is followed by some limitation in the range of movement, namely, an inability to adduct the limb beyond the neutral position, and about half an inch to three-quarters of an inch of shortening occurs, but this loss is hardly noticed by the patient. Thus the operation, if union occurs, produces a result very little short of perfection, and, if union does not occur, the patient is assured of a satisfactory hip upon which he can walk. I believe that this treatment for a condition which has always been a problem, is much more reasonable than an operation which gives perfection in some cases with crippling as the penalty of failure. The one disadvantage is that a period of fixation in plaster is necessary, because it is absolutely essential to get union at the osteotomy. This makes the method unsuitable for a small

percentage of patients—those who are very frail or have poor skin, but in my experience age in itself is no contraindication to immobilization in plaster. Most reasonably fit old people stand plaster treatment quite well. Another point is that it can be done when adequate X-ray facilities are not available, and under these conditions should certainly be the method of choice. The plaster applied holds the limb in the neutral position and it has neither the disadvantages nor the discomfort of a plaster applied in the extreme position demanded by the Whitman technique; the knee also does not become as stiff, because it is immobilized in a position involving no strain.

### *The Operation.*

The patient is put to bed and continuous traction is applied for a few days until the fracture is reduced and the leg regains its normal length. Then under nitrous oxide or spinal anaesthesia an incision is made down the lateral side of the leg, starting just above the trochanter and extending down the femur. The femur is exposed and by a little further dissection the under-surface of the neck is brought into view. This is an important step in the operation, because it is essential to know exactly where to divide the bone, and this is a very adequate guide. The bone is then divided at such a level that the shaft can be pushed medially to occupy a position under the head of the femur and the acetabulum. This means that the cut in the bone is usually made just above the level of the lesser trochanter. After the shaft is displaced medially the wound is sewn up and plaster is applied with the leg in moderate abduction. After about two weeks the plaster is changed, the leg this time being placed in the neutral position with slight flexion at hip and knee. This plaster is kept on for about three months to ensure firm union at the osteotomy, and during this period the patient may go home if he so desires. The plaster is then removed and exercises and physical therapy are instituted to restore movement, the patient at the same time starting walking without any appliance on the leg. The operation takes only about fifteen minutes and causes no shock. It can be done without elaborate X-ray facilities and really requires only a slightly increased disability period because many people believe that three months' relief from weight bearing is necessary after insertion of a pin. This method of treatment has been carried out by McMurray, who has published four cases in all of which union occurred, and who has since done several more with very satisfactory results. Paton, who has not published any results, has also told me that he is very pleased with this method of treatment. Putti is using this method for those cases in which he thinks the proximal fragment is unlikely to retain an adequate grip on a pin. These he regards as potential cases of non-union and in his earliest case the patient was operated upon one month after the accident. I have performed the operation once only, and this yielded a very satisfactory hip in spite of failure to secure union at the fracture. In this case the reduction was not adequate, and this rather increased the shortening and prejudiced the chance of union. Serial skiagrams showed a density of the head that was relatively marked when compared with the rest of the bone, suggesting that it was an example of "aseptic necrosis".

I believe that union would not have been obtained by any method in this case, and yet after four months the patient was able to walk.

The patient, a man of seventy-three years, was operated upon on March 26, 1938, a subtrochanteric osteotomy being performed. He was discharged to his home in plaster on April 21, 1938, and was readmitted to hospital for removal of the plaster on July 4, 1938, just over three months after the operation had been performed. Six weeks later he was walking fairly well with assistance and had 30° of movement at the hip and 45° at the knee. In a further six weeks he was walking quite well with one stick and stated that he was on his feet all day. Six weeks later still he had 70° of flexion and 10° of abduction movement at the hip and over 90° at the knee. His return of movement was unduly slow because he absolutely refused to come up for physical therapy. He finished up with half an inch apparent shortening and an inch and a half of real shortening. This is rather greater than is usually obtained, but the patient found it no disability.

One point I would like to emphasize is that, although one or two technical mistakes were made in this operation, which resulted in an increase in the usual amount of shortening, and through failure to reduce the fracture, there was practically no chance of union, yet the patient finished up with a useful satisfactory hip.

I am prepared to grant that relatively few operations of this kind have been done, but the results from the point of view of producing a satisfactory hip have been so good that I think the method deserves serious consideration and a further extended trial, especially in the case of the subcapital fracture, which has always been the most difficult to treat with a pin.

Also I am prepared to grant that the method is not suitable for all cases, and I have placed the patients into three groups:

1. Those whose general condition is so bad that no active treatment is possible.
2. Those who, for some reason, such as frailty or obesity, cannot be treated in plaster. Then the insertion of a pin is the only alternative to doing no active treatment at all.
3. Those who are suitable for any form of treatment, and these, with few exceptions, are most satisfactorily treated by an osteotomy.

It will be noticed that I have not mentioned Whitman's method. This is because I believe that it should no longer be used. There may be something to be said for treatment with a pin in some cases, but, if plaster is to be used, there is no reason for the omission of a simple surgical procedure which will raise the percentage of satisfactory results from 60% to 70% to the region of 100%.

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## OTOGENOUS MENINGITIS.<sup>1</sup>

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In this paper it is my intention firstly to discuss some aspects of the treatment of otogenous meningitis, intentionally omitting petrositis, and secondly to review a series of forty cases which have occurred at the Victorian Eye and Ear Hospital during the past five years.

### SPREAD OF INFECTION.

The focus of infection in otogenous meningitis may be extralabyrinthine or labyrinthine. In the extralabyrinthine group spread of infection to the subarachnoid space may be: (a) Blood-borne, that is, directly along thrombosed or infected vessels passing from the middle ear or mastoid to the meninges. (b) Osseous, that is, step by step through bone, dura and arachnoid. In regard to this method of spread we have, during the past few years, gained a knowledge of suppuration in the perilabyrinthine cells and of empyema of the petrous apex. (c) From abscesses. Indirectly the subarachnoid space may become invaded as a result of rupture of a cerebral abscess into the ventricle, or of a cerebellar abscess into the *cisterna pontis*.

In the labyrinthine group infection spreads usually via the internal auditory meatus or the cochlear aqueduct, occasionally via the vestibular aqueduct, and rarely by other routes.

### SURGICAL TREATMENT.

Surgical treatment will vary according to the pathology of each particular case, the essential aims being (a) the complete removal of the infecting focus where possible, and (b) the establishment of free external drainage when the focus cannot be removed in its entirety. In extralabyrinthine cases it is usual to perform some type of mastoid operation and to expose widely the dura of the middle and posterior fossæ (after the method of Neumann). When indicated, the petrous apex should be explored and drained. As Sacks says, with a wide exposure of dura one is more apt to find or to rule out an extradural abscess or the thickened discoloured dura of localized pachymeningitis, beyond which may be a subdural abscess. At any rate, one has at least broken off the vessels from the mastoid or attic to the dura. Sometimes the question arises as to whether any portion of the dura so exposed should be excised. Sacks considers that in diffuse purulent leptomeningitis when the path of invasion is recognized, the nearest collection of cerebro-spinal fluid should be evacuated by an incision of the dura. Eagleton operates in serous meningitis when there is merely a slightly

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increased cell count, and before organisms are present in the fluid. He incises the dura adjacent to the primary focus of infection, if he finds one. This procedure appears to have dangerous possibilities which outweigh the benefits it might confer. A more moderate and sounder view in my opinion is that held by Cawthorne, who incises the dura after removing the primary focus only when organisms are present in the cerebro-spinal fluid, and when the organisms are similar to those found in the infected mastoid.

In labyrinthine cases with meningitis, Neumann's labyrinthectomy with an extension to the internal auditory meatus appears to give the best drainage. T. G. Millar recently reported four cases of otogenous meningitis secondary to labyrinthitis in which drainage by this method was used. Although all four occurred in the pre-sulphanilamide era, there were three recoveries. There is still some difference of opinion as to the best time to operate in a case of acute diffuse purulent labyrinthitis. In many of these cases the condition settles down spontaneously, and, on the other hand, in some it goes on to a meningitis. It appears rational to adopt a policy of masterful inactivity and watchful expectancy, and to operate on the labyrinth only if and when the earliest signs of meningitis appear. Lund states that for six years he adhered to the radical view of the Vienna school, which maintains that every case of acute labyrinthitis with a dead labyrinth calls for immediate labyrinthectomy. For eight years he adopted a more conservative attitude and operated upon the labyrinth only when clinical signs of meningitis were present; and during the last fourteen years, in which period he obtained his best results, his indications for labyrinthectomy were made dependent on his examination of the cerebro-spinal fluid.

#### MEDICAL TREATMENT.

##### *Lumbar Puncture.*

Lumbar puncture may be (a) diagnostic or prognostic, (b) therapeutic.

Diagnostic puncture should be performed when one suspects that meningitis is developing. For this purpose it is not necessary to remove more than two cubic centimetres. In regard to the earliest signs of meningitis Symonds lays special emphasis on the importance of headache and vomiting, especially if these symptoms are associated with a rise in temperature. Layton regards neck rigidity as the first sign of importance.

Therapeutic puncture should be regarded as an essential part of the treatment of otogenic meningitis. Penington maintains that repeated lumbar puncture is essential to relieve the increased intracranial pressure, to decrease the toxæmia, and to increase the passage of drugs into the cerebro-spinal fluid. In a series of cases at Saint Bartholomew's Hospital analysed by Jory, lumbar puncture was done in every instance, and was repeated when possible once or twice a day. Among this series of thirty-nine patients there were three recoveries, and, as only four of the thirty-nine were given serum treatment, it is probable that repeated lumbar puncture was, with the exception of the appropriate operation, the greatest single aid to recovery. Thompson considers that the maintenance of a normal cerebro-spinal fluid pressure would favour the passage of the antibodies into that fluid. Gubner states that drug therapy should be supplemented by daily spinal drainage to relieve pressure. Bowen-Davies, in discussing a case of otogenous meningitis, in which both continuous spinal drainage and "Prontosil" treatment were used, and in which the lumbar puncture needle became temporarily



blocked and had to be removed for a day or so, writes: "The favourable progress of this case after the administration of prontosil seems to have been misleading, for the removal of the needle caused a rise in temperature and a deterioration of the general condition."

The normal pressure of the cerebro-spinal fluid may be regarded as varying between one hundred and two hundred millimetres of water with the patient relaxed and in the horizontal position. Greenfield states that a pressure above two hundred millimetres of water is definitely pathological. He advises that the pressure should always be estimated before any fluid is withdrawn by puncture, and that it is unwise to continue withdrawal after the pressure has fallen to two-thirds of its initial value. In the continuous spinal drainage method the pressure is kept at one hundred millimetres of water. Penington says that in doing a lumbar puncture it is essential to use a manometer, and he points out that the pressure of the fluid must not be reduced below normal. It would seem that frequently far too little attention is paid to therapeutic lumbar puncture. In many cases the pressure is never taken either before or after the withdrawal of fluid. Again, lumbar puncture, instead of being repeated daily or more often, is done perhaps twice in a week or ten days, and then possibly more as a guide to the progress of the condition than as a major therapeutic measure. In others it is done sporadically, primarily with the object of relieving the headache.

#### *Chemotherapy.*

Remarkable recoveries have been reported since the use of the sulphanilamides. Schenck states that the number of recoveries from streptococcal meningitis since sulphanilamide has been made available now exceeds the total number from 1901 to 1937. Cumming reports a series of nine cases with six recoveries, and Dr. Josephine Neal reports a series of eleven cases of meningitis due to the hæmolytic streptococcus in which sulphanilamide or "Prontosil" was used and among which there were nine recoveries. Cawthorne states that the drug acts not so much by destroying the disease in its primary focus as by neutralizing the circulating toxins and bacteria. He stresses the view that it must not be used as a substitute for surgery. Kopetzky states that all therapy would seem to be ineffective if the original focus is not removed. He considers that sulphanilamide will clear body fluids infected by streptococci, but that it does not seem able to kill streptococci located in an active bone lesion.

Sulphanilamides may be given by mouth, parenterally or intrathecally. Cawthorne suggests a maximum dose of one gramme in twenty-four hours for every twenty pounds of body weight. It should be given, generally speaking, by mouth, but in young children and delirious patients it is best given subcutaneously as a 0.8% solution in normal saline solution. The drug readily finds its way into the cerebro-spinal fluid when given orally or parenterally.

Recently a drug of the sulphanilamide group known as "M & B 693" has become available. This drug is very potent against pneumococci, and in addition it has weight for weight as great a potency against streptococci as "Proseptasine" or sulphanilamide itself. Therefore this would appear the best chemotherapeutic agent with which to commence treatment while awaiting a report as to the infecting organisms.

### *Hæmotherapy.*

Hæmotherapy is advised by Kopetzky, who believes that small blood transfusions given every day or every second day are of great value in handling the bacterial invasion, in bringing the chemistry of the cerebro-spinal fluid towards normal, and in making blocking of the flow at the natural ventricular openings much less likely to occur. Cawthorne does not favour hæmotherapy unless there is a coexistent septicæmia or a deficient blood count.

### *General Measures.*

General measures, such as administration of free fluids, maintenance of good elimination and absolute quiet, all play their part in helping the patient to get well. After recovery, he should live quietly for some weeks before resuming his normal activities. If cerebral irritation persists during this period, Penington advises the administration of bromide or "Luminal"; small doses may be indicated for some months.

### ANALYSIS OF A SERIES OF FORTY CASES OCCURRING AT THE VICTORIAN EYE AND EAR HOSPITAL.

I have investigated a series of forty cases of diffuse leptomeningitis of otitic origin which occurred at the Victorian Eye and Ear Hospital during the past five years. Of the forty patients, thirty-six died and four recovered. The sexes were represented by twenty-eight males and twelve females. The age distribution was as follows: there were nine patients under ten years of age (the youngest being three and a half months), twelve patients twenty years or under, three patients thirty years or under, four patients forty years or under, seven patients fifty years or under, four patients sixty years or under, and one aged sixty-two years. In twenty-eight cases, that is, in almost three-quarters of the total, meningitis followed acute otitis, the average age of the patients being twenty-two. In ten cases the otitis was chronic, the average age in this group being a little higher, namely, twenty-eight years. In the remaining two cases the otitis was of a few months' duration and might be termed subacute. In a series of thirty-nine cases of otogenous meningitis occurring at Saint Bartholomew's Hospital the proportions were much the same, only a quarter of the total following chronic otitis, the remaining three-quarters complicating acute or subacute infections.

### *Route of Infection.*

In this series, so far as can be ascertained, the focus of infection was extralabyrinthine in thirty-six cases and labyrinthine in only four. There is evidence either at operation or at post-mortem examination that in the extralabyrinthine group there were at least five cases of petrositis, six of cerebral abscess, two of cerebellar abscess and three of sinus thrombosis.

### *Bacteriological Findings.*

Streptococci were present in fourteen cases (eight in stained film alone, two on culture alone, four on both smear and culture). Pneumococci were present in five instances (three on smear alone, one on culture alone, one on both smear and culture). In two cases Gram-positive organisms were found in smears, and in one case Gram-positive cocci and diplococci were

found in a smear. All three cases were probably streptococcal. The ratio of streptococcal to pneumococcal infection would thus be a little greater than 3:1. In three cases no organisms could be demonstrated in a smear (the fluid in these was probably examined before the meningitis had become diffuse), and in twelve there is no record of bacterial investigation. In all four cases in which recovery occurred the streptococcus was the infecting organism (in three of the cases organisms were present in a stained film, and in the fourth non-hæmolytic streptococci were isolated on culture).

#### *Recovery Rate.*

Four patients recovered and three of these cases occurred in the pre-sulphanilamide era; these three represent 7.5% of the total. Neumann has reported 59 cases of otitic meningitis in which six patients who had organisms in the cerebro-spinal fluid, that is, 10.1%, recovered. Tripoli found a recovery rate of 8.4%. Gray found in the literature from 1901 to 1935 records of 66 patients suffering from streptococcal meningitis who had recovered, and the recovery rate was estimated at 3%. Neal found that 5% had recovered over a period of twenty-six years including 1936.

#### *Treatment.*

*Surgical Treatment.* In thirty-one cases a Schwartze mastoid operation was the first procedure and in others a radical mastoidectomy was the operation chosen. Further exploration was frequently found necessary. From the operation notes it appears that the exposed dura and sinus in the great majority of cases appeared normal. The labyrinth was drained in seven instances (sometimes it would seem rather on speculation), the jugular vein was ligated on three occasions, and Dandy's cisternal drainage operation was performed once. In three cases the *dura mater* was incised and access gained to the subarachnoid space or underlying brain substance, and these three cases include two of the four in which recovery took place. There is no record of any exploration or drainage of the petrous apex. In regard to labyrinthectomy there was one patient in whom the earliest signs of meningitis were first apparent the day following the operation. Prior to labyrinthectomy diagnostic lumbar puncture had not been done.

*Medical Treatment.* Medical treatment, apart from the administration of free fluids, the occasional use of hypotonic saline solution, sedatives *et cetera*, consisted mainly in the administration of antistreptococcal serum and lumbar puncture; thirteen of the forty patients received serum. A few patients died shortly after admission before treatment could be instituted. Lumbar puncture was done sometimes daily, but often only sporadically, and it was not customary to estimate the pressure of the fluid by manometry either before or after this procedure. Sulphanilamide or an allied drug was used in four of the later cases of the series; in one of these recovery occurred. In one case it was given once by injection. In a second it was given orally in large doses for eight days; this patient died, but at post-mortem examination was found to have an undrained empyema in the petrous apex. In another case in which the patient died, "Prontosil" was used only once and by injection. In the fourth case, that in which recovery occurred, "Prontosil" was given parenterally and "Proseptasine" was given orally, each for a number of days.

Case Number.	Focus of Infection.	Cerebro-spinal Fluid.	Surgical Treatment.	Medical Treatment.	Result.
I	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. Culture: Streptococci.	1. Schwartz mastoidectomy (dura and sinus appeared normal). 2. Later, ligation of jugular and common facial veins (no pathology found).	1. Daily lumbar puncture, 10 cubic centimetres intramuscularly (twice).	Died.
II	Acute suppurative <i>otitis media</i> , ? mastoiditis, petrositis.	Turbid. Smear: intracellular and extracellular streptococci.	Schwartz mastoidectomy, very extensive, an exposed eighth nerve cells despite sixth nerve paralysis and meningitis.	1. Daily lumbar puncture on four successive days. 2. "Feldman" (on three successive days). 3. "Feldman" (on three successive days). 4. Antistreptococcal serum by three routes on various days (120 cubic centimetres in all).	Died.
III	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. 870 cells, chiefly polymorphonuclear cells, occasional Gram-positive cocci and diplococci.	Schwartz mastoidectomy. Dura of middle fossa and of sinus appeared normal.	Lumbar puncture on three occasions.	Died.
IV	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. 800 cells, chiefly polymorphonuclear cells. Smear: streptococci present in clumps and pairs.	1. Double Schwartz mastoid. 2. (30 days later). Reopening one mastoid.	Antistreptococcal serum 20 cubic centimetres once.	Died.
V	Acute suppurative <i>otitis media</i> , mastoiditis, cerebral abscess.	Very turbid. Smear: large number pus cells, morphologically typical pneumococci present.	Schwartz mastoid, pulsating pus from antrum; dura and sinus appeared normal.	—	Died.
VI	Acute suppurative <i>otitis media</i> , labyrinthitis, sinus thrombosis.	Opalescent. 1,260 cells, polymorphonuclear cells, and mononuclear cells mixed.	Radical mastoid and labyrinthectomy (no pus found in labyrinth).	Lumbar puncture three times in ten days.	Died.
VII	Acute suppurative <i>otitis media</i> , mastoiditis, cerebral abscess.	8,000 cells, polymorphonuclear cells. Smear: Gram-positive diplococci, morphologically pneumococci.	1. Schwartz mastoidectomy. 2. (after one month). Reopening mastoid. 3. (after further ten days). Radical mastoidectomy and labyrinthectomy.	—	Died.
VIII	Acute suppurative <i>otitis media</i> , mastoiditis.	Opalescent. Smear: Gram-positive cocci and diplococci. Culture: pneumococci.	Schwartz mastoidectomy; dura and sinus appeared normal, no obvious pus.	Lumbar punctured once during the day between operation and death.	Died.
IX	Acute suppurative <i>otitis media</i> , mastoiditis.	Slightly turbid. 90 cells. Smear: no organism seen.	1. Schwartz mastoidectomy. 2. (nine days later). Mastoid reopened, dura and sinus normal, no pus.	Lumbar puncture performed four times.	Died.
X	Acute suppurative <i>otitis media</i> , mastoiditis.	—	—	None. Died on day of admission.	Died.

Case Number.	Focus of Infection.	Cerebro-spinal Fluid.	Surgical Treatment.	Medical Treatment.	Result.
XI	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. Smear: many pus cells. Gram-positive cocci and streptococci.	Schwartzke mastoidectomy.	Diabetic treatment. Meningitis first apparent on day before death.	Died.
XII	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. Smear: polymorphonuclear cells and short-chained streptococci. Culture: haemolytic streptococci.	Radical mastoidectomy and labyrinthectomy (dura and sinus normal).	Lumbar puncture performed twice.	Died.
XIII	Acute suppurative <i>otitis media</i> (right and left), mastoiditis.	Turbid. Culture: no growth in forty-eight hours.	Double Schwartz mastoidectomy.	During sixteen days between onset of symptoms and death. 1. Lumbar puncture was performed twice. 2. Antistreptococcal serum intrathecally.	Died.
XIV	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. 200 cells. Culture: short-chained streptococci.	1. Schwartz mastoidectomy. 2. Mastoid reopening, three days later, infected bone in tegmen.	—	Died.
XV	Acute suppurative <i>otitis media</i> , mastoiditis, cerebellar abscess.	Turbid. 256 cells, chiefly polymorphonuclear cells.	1. Schwartz mastoidectomy. 2. Mastoid reopening twelve days later, dura and sinuses normal.	Lumbar puncture performed twice.	Died.
XVI*	Acute suppurative <i>otitis media</i> , labyrinthitis.	Very turbid. 5760 cells. Culture: pneumococci, <i>Staphylococcus aureus</i> and <i>albus</i> .	1. Schwartz mastoidectomy. 2. Labyrinthectomy. 3. Transverse drainage. 4. Dandy's external drainage.	1. Lumbar puncture plus continuous external drainage. 2. Antistreptococcal serum 30 cubic centimetres on two occasions. 3. Hypotonic saline solution.	Died.
XVII	Acute suppurative <i>otitis media</i> , mastoiditis, petrositis.	—	Schwartz mastoidectomy.	—	Died.
XVIII	Acute suppurative <i>otitis media</i> , mastoiditis, petrositis.	Turbid.	1. Schwartz mastoidectomy. 2. Conservative mastoidectomy (ten days later). 3. Labyrinthectomy (two days later).	1. Lumbar puncture performed twice. 2. Antistreptococcal serum 30 cubic centimetres in all.	Died.
XIX	Acute suppurative <i>otitis media</i> , mastoiditis, petrositis.	10 to 20 cells.	Schwartz mastoidectomy and ligation of jugular and common facial veins.	—	Died.
XX	Acute suppurative <i>otitis media</i> (right and left), mastoiditis.	Turbid. Smear: Gram-positive cocci and diplococci.	Schwartz mastoidectomy (double).	1. Lumbar puncture performed once. 2. Antistreptococcal serum 30 cubic centimetres (death two days after operation).	Died.
XXI	Acute suppurative <i>otitis media</i> , mastoiditis.	Turbid. 800 cells. Smear: Gram-positive cocci and diplococci, probably pneumococci.	Schwartz mastoidectomy.	1. Lumbar puncture twice daily for two days. 2. Cisternal drainage (once). 3. Antistreptococcal serum, 20 cubic centimetres twice.	Died.

Case Number.	Focus of Infection.	Cerebro-spinal Fluid.	Surgical Treatment.	Medical Treatment.	Result.
XXII	Acute suppurative <i>otitis media</i> , mastoiditis.	Opalescent. Smear: Gram-positive organisms (streptococci).	Schwartz mastoidectomy.	Antistreptococcal serum by three routes for one day (death occurred day after operation).	Died.
XXIII	Acute suppurative <i>otitis media</i> , mastoiditis, <i>sinus thrombosis</i> .	—	Schwartz mastoidectomy; little pus, sinus and dura appeared healthy.	—	Died.
XXIV	Acute suppurative <i>otitis media</i> , mastoiditis.	Under pressure.	Schwartz mastoidectomy; sinus healthy; dura ? not healthy.	—	Died.
XXV	Acute suppurative <i>otitis media</i> , labyrinthitis.	Cloudy, greatly increased pressure.	Radical mastoidectomy and labyrinthectomy (mastoid clear).	—	Died.
XXVI	Acute suppurative <i>otitis media</i> , mastoiditis, cerebral abscess.	—	—	Schwartz mastoidectomy.	Died.
XXVII*	Acute suppurative <i>otitis media</i> , mastoiditis.	5,000 cells, chiefly polymorphonuclear cells. Smear: Gram-positive cocci and diplococci and streptococci.	Schwartz mastoidectomy, pus obtained, dura and sinus appeared healthy.	1. Lumbar puncture performed four times (successive days). 2. Antistreptococcal serum 10 cubic centimetres intrathecally (four successive days), 10 cubic centimetres each intravenously and intramuscularly (seven successive days).	Recovered.
XXVIII	Acute suppurative <i>otitis media</i> , mastoiditis.	Opalescent. 250 cells. Culture: haemolytic streptococci.	Schwartz mastoidectomy; dura of middle fossa and of sinus appeared normal.	1. Lumbar puncture performed four times (successive days). 2. Antistreptococcal serum 10 cubic centimetres intrathecally (twice).	Died.
XXIX	Subacute suppurative <i>otitis media</i> , double mastoiditis, petrositis, <i>sinus thrombosis</i> .	Turbid. 6,000 polymorphonuclear cells. Smear: intracranial and extracranial streptococcal clots, <i>Streptococcus microaerophilus</i> .	Left Schwartz mastoidectomy, dura and sinus normal. Curettage of sinus going toward petrous.	1. Lumbar puncture performed once. 2. "Proseplasin" 10 cubic centimetres intramuscularly (once).	Died.
XXX	Subacute suppurative <i>otitis media</i> , mastoiditis, cerebral abscess.	—	Schwartz mastoidectomy; cerebral abscess communicated by a clink with the antrum.	—	Died.
XXXI*	Chronic suppurative <i>otitis media</i> , mastoiditis.	Turbid. Smear: streptococci.	Schwartz mastoidectomy, opening found through dura above <i>femoral antri</i> and drainage tube inserted through this.	1. Lumbar puncture (in addition to cerebro-spinal fluid drainage the mastoid). 2. "Prontosil" for several days, one injection of five cubic centimetres and two tablets every four hours and later three times a day.	Recovered.



Case Number.	Focus of Infection.	Cerebro-spinal Fluid.	Surgical Treatment.	Medical Treatment.	Result.
XXXII*	Chronic suppurative otitis media, mastoiditis.	Turbid. 1,760 cells. Smear: Gram-positive intracellular organisms.	Schwartz mastoidectomy.	1. Lumbar puncture (seven times in four days). 2. Antistreptococcal serum by three routes (200 cubic centimetres in all). 3. Therapy orally, intrathecally. 4. "Edwin."	Recovered.
XXXIII	Chronic suppurative otitis media, mastoiditis, cerebral abscess.	—	Radical mastoidectomy with drainage of cerebral abscess. Mural cholesteatoma and offensive pus.	—	Died.
XXXIV	Chronic suppurative otitis media, mastoiditis, cerebral abscess.	Clear: under pressure, 110 cells, 10% polymorphonuclear cells. Smear: no visible organisms (cerebral abscess only at this time).	1. Schwartz mastoidectomy, extradural abscess. 2 (three days later). Mastoid reopening, necrotic dura removed.	—	Died.
XXXV*	Chronic suppurative otitis media, mastoiditis, cerebellar abscess.	Opalescent, 500 cells. Smear: Gram-positive cocci. Culture: non-haemolytic streptococci.	Radical mastoidectomy, incision of dura, evacuation of pus and brain tissue, tube sewn through incision.	1. Lumbar puncture performed twice on successive days. 2. Antistreptococcal serum 10 cubic centimetres intrathecally twice, 25 cubic centimetres intramuscularly twice, 30 cubic centimetres subcutaneously (four times).	Recovered.
XXXVI	Chronic suppurative otitis media, mastoiditis.	Turbid, 230 cells, mainly polymorphonuclear cells. Smear: Gram-positive intracellular cocci.	Removal of aural polypus.	1. Lumbar puncture performed twice. 2. Antistreptococcal serum intrathecally and intramuscularly once. (Died four days after admission.)	Died.
XXXVII	Chronic suppurative otitis media, mastoiditis.	Turbid. Smear: streptococci.	Schwartz mastoidectomy with incision of dura in two places. Cholesteatoma.	Died on day of admission.	Died.
XXXVIII	Chronic suppurative otitis media, mastoiditis, stoma thrombosis.	Cloudy.	Schwartz mastoidectomy with ligation of jugular and common facial veins.	—	Died.
XXXIX	Chronic suppurative otitis media, labyrinthitis.	Turbid. 1,280 cells, chiefly polymorphonuclear cells. Smear: Gram-positive cocci in short chains.	Conservative mastoidectomy, coecilia opened.	Lumbar puncture performed once.	Died.
XL	Chronic suppurative otitis media, mastoiditis.	Culture: haemolytic streptococci.	1. Ostelectomy. 2. (later). Radical mastoidectomy. No pus found—labyrinthectomy (on speculation).	1. Lumbar puncture daily from operation until death (four days). 2. Antistreptococcal serum plus air intrathecally (three times).	Died.

*Brief Summary of the Four Cases in which Recovery Occurred.*

CASE I.—A.L., a male, aged eighteen years (number 27 on the list), had an acute otitis and mastoiditis for which a Schwartz mastoidectomy was performed ten days after the onset. A little pus was present in the antrum and cells, but the dura of the middle fossa and the sinus appeared healthy. Lumbar puncture was done and the fluid contained 4,500 cells per cubic millimetre; polymorphonuclear cells predominated, and Gram-positive cocci, diplococci and streptococci were found. Ten cubic centimetres of antistreptococcal serum were given intrathecally and twenty cubic centimetres intramuscularly. Next day the patient was given 10 cubic centimetres intrathecally, 10 cubic centimetres intravenously and 10 cubic centimetres subcutaneously. This was repeated daily for seven days, the intrathecal injection being omitted after the third day.

CASE II.—E.H., a male, aged sixteen years (number 31 on the list), had an acute exacerbation of a chronic inflammation of the ear for which four Schwartz mastoidectomies had previously been performed, the last about three years prior to examination. There was severe headache with one attack of vomiting, and lumbar puncture liberated turbid fluid from which streptococci were demonstrated in a smear. A Schwartz mastoidectomy was performed the same day and an opening was found through the dura above the *tegmen antri*. A drain tube was inserted through this fistula and from it cerebro-spinal fluid drained for some days. During the next fortnight lumbar puncture was performed twice and "Prontosil" given as follows: one injection of five cubic centimetres; "Prontosil" tablets (two) every four hours for five days, then two tablets three times a day for a further few days.

CASE III.—C.W., a female, aged five years (number 32 on the list), presented herself with an acute flare-up of an ear which had discharged for four months. A Schwartz mastoid operation was performed. Some hours later the patient had a fit. Lumbar puncture was then done, and the fluid appeared clear and under normal pressure. Ten cubic centimetres of antistreptococcal serum were given, together with four cubic centimetres of air intrathecally; twenty cubic centimetres were given intramuscularly. On the following day lumbar puncture was repeated, and this time the fluid was turbid, under increased pressure, and contained 1,760 cells per cubic millimetre and a few Gram-positive intracellular organisms. Thirty cubic centimetres of antistreptococcal serum were given, also one cubic centimetre of "Edwinal", and hexamine, grains seven, was prescribed to be taken three times a day. Later still on this day lumbar puncture was repeated and 10 cubic centimetres of serum were given intrathecally and 20 cubic centimetres intramuscularly. On the following day lumbar puncture was again done and 20 cubic centimetres of serum were injected. Next day 30 cubic centimetres of serum were given rectally, lumbar puncture was repeated, and 25 cubic centimetres of serum were given by injection. The next day the patient was not so well, had neck retraction and rigidity, was drowsy and restless and had a marked Kernig's sign. Lumbar puncture was repeated and 20 cubic centimetres of serum were given. Nourishment was pushed by both rectal and oral routes. From this time improvement was manifest and the following day lumbar puncture was once more performed; 15 cubic centimetres of serum plus three cubic centimetres of air were given intrathecally, and 15 cubic centimetres of serum in 30 cubic centimetres of saline solution were given rectally.

CASE IV.—J.D., a female, aged twelve years (number 35 on the list), gave a history of otorrhoea for six years, with pain, headache and fever for two days. Head retraction was present. On September 1 a radical mastoidectomy was performed, the *dura mater* over the cerebellum was incised and pus and brain tissue under increased pressure were evacuated. A tube was inserted through the dural opening and sutured in position. Lumbar puncture at this time revealed opalescent fluid containing 500 cells per cubic millimetre, mostly polymorphonuclear cells, and long-chained non-hæmolytic streptococci were grown on culture. At the time of operation, eight cubic centimetres of antistreptococcal serum were injected intrathecally and 24 cubic centimetres were given intramuscularly. Further treatment was as follows. On September 2 lumbar puncture was performed, 10 cubic centimetres of serum were given intrathecally and 30 intramuscularly. On September 3 30 cubic centimetres of serum were given subcutaneously. This dose of 30 cubic centimetres was repeated every day for the next four days.

The question as to whether it is wise to drain a labyrinth in a case of acute labyrinthitis without signs of commencing meningitis is raised by the following case, the brief details of which are as follows.

G.D., a male, aged seventeen years (number 16 on the list), was first seen on May 11 with acute suppurative *otitis media* of five days' duration. Myringotomy was performed. On May 18 there was profuse otorrhœa and the patient vomited frequently. His temperature was 97° F., and his pulse rate 70 in the minute. Very little hearing was present in the right ear and the patient was admitted to hospital for observation. Further examination in bed revealed giddiness, mastoid tenderness, first degree nystagmus to the opposite side, slight caloric action in three minutes. On May 22 a Schwartz mastoidectomy was performed. On May 26 labyrinthectomy was performed and there was a copious discharge of fluid from the vestibule. On May 27, that is, the day following labyrinthectomy, the patient was not so well. A little neck rigidity was present, but no Kernig's sign could be elicited. On May 29 lumbar puncture was performed for the first time. The fluid was cloudy and contained 800 cells per cubic millimetre. On May 30, 1,280 cells were present, but no recognizable organisms. On June 1 the fluid was deeply opaque, contained 5,760 cells, and an occasional Gram-positive intracellular organism. On June 15 pneumococci were isolated. Death occurred shortly afterwards.

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## SOME ASPECTS OF STREPTOCOCCAL INFECTIONS OF THE PHARYNX.<sup>1</sup>

By F. V. SCHOLES,  
Melbourne.

IN June, 1938, in Brisbane I addressed a post-graduate group on the subject of complications of streptococcal pharyngitis, and the lecture was published in *The Medical Journal of Australia* in December. Some of your members were interested in certain parts of the paper, notably those in which the remote effects of infection were discussed, and kindly suggested that I should make a brief communication to you on these matters. When I do so, I hope that you may be able to enlighten me on the best means by which we may attempt to prevent or to minimize the results of these remote effects.

Without full discussion, and making no allowance for exceptions, I propose to set down a few general statements as a basis.

1. Throughout life the pharyngeal mucous membrane is receiving depositions of bacteria. According to their situation and superficial structure, some parts receive and retain more than others.

2. In the presence of bacterial infection it is a function of the whole area receiving such stimuli to react to them. It is its business to ensure that so far as possible the results of such stimuli shall be of an immunizing rather than a disease-producing nature.

3. If such stimuli merely provoke the production of antibodies, or even if a fairly extensive superficial inflammation is necessary, provided that regeneration of tissue is complete, no harm is done, and a step is taken towards immunity. But if there is suppuration, ulceration or other destruction of tissue which must be replaced by fibrous tissue, local harm is done, whatever may be the steps taken towards general or local immunity.

4. By virtue of its situation and structure and its close relation with the lymphatic and general circulation, the faucial tonsil is peculiarly fitted for the reception of stimuli. Toxins and bacterial products normally pass from the tonsil, thus evoking the production of tissue and humoral antibodies.

5. But if living bacteria are carried through to the tissues, inflammation must be attempted, and, according to its degree of success, there is subsidence, suppuration (local or pyæmic), ulceration or necrosis, whether the seat of deposition of bacteria be the cervical glands, the endocardium, or a joint.

Now in certain persons, after a silent period following acute pharyngitis, there appear symptoms of what we call lymphadenitis, acute nephritis or acute rheumatism. It has been thought that these follow and are due to a fresh outpouring of toxins and/or invasion of bacteria (either by the original strain of bacterium or by a second strain). Such invasion by a second strain is a common cause of otitis, sinusitis, lymphadenitis and other such

<sup>1</sup> Accepted for publication on April 27, 1939.

complications of tonsillitis, and of relapse in scarlet fever, and it is difficult to believe that it is not present in some cases in which with repeated attacks of pharyngitis we have repeated attacks of rheumatism following progressively shorter silent periods.

We have for some time past at Fairfield been investigating changes of bacterial type in scarlet fever. While I regret that sufficient evidence is not yet available, observations so far tend to confirm what I had previously believed, that change of type is not necessary for the production of acute

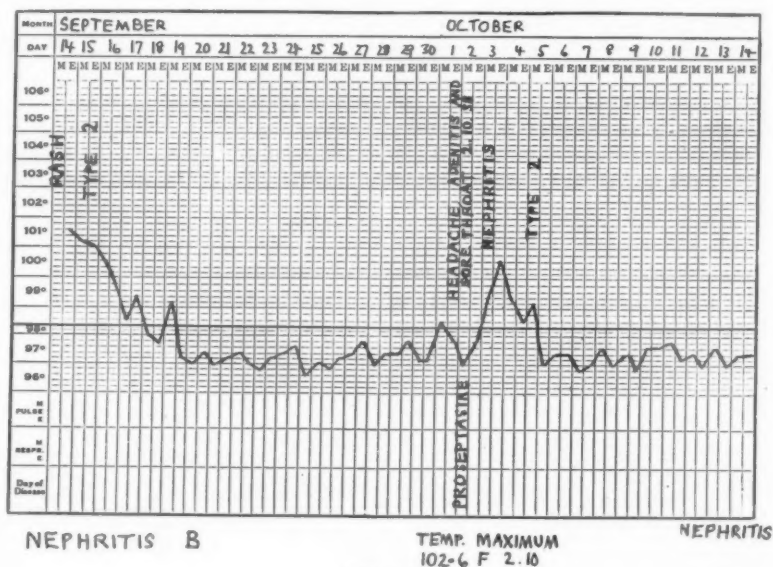


CHART I.

rheumatism, nephritis or lymphadenitis. Further, in three recent cases, on examination of the throat on the day following the development of nephritis, no streptococci have been found.

There is the second possibility that neither invasion of tissues by bacteria nor fresh diffusion of exotoxins is responsible or necessary. As a rule bacteria cannot be demonstrated in the kidney, blood, lymph glands or rheumatic lesions, and these complications occur commonly in persons who do not react to the Dick test. Apparently other soluble antigens are formed.

We need not discuss the nature of the actual attack, but evidence points most strongly to a failure of proper development of antibody to these other antigens, coinciding in time with a state of tissue hypersensitivity. If this is so, the attack of rheumatism, of nephritis and of adenitis is a phenomenon of what is loosely called an allergic nature.

I remember a cynical description of "allergy" as "an endeavour to interpret phenomena about which we know little by means of conceptions about which we know even less". Be that as it may, I am inclined to believe

that Aschoff's opinion that rheumatism is not an allergic disease, but an infective or toxic disease with an allergic phase, is as near to the truth as we can approach at this moment.

Whatever the mechanism, we can surely regard rheumatic endocarditis and pericarditis as manifestations of the same process as in those mentioned, and bacterial endocarditis as a result of later deposition of bacteria on the old lesion, or on some other lesion, for example, congenital.

#### NOTES ON THE ACCOMPANYING CHARTS.

CHART I.—Typical nephritis (Class B) appeared on the nineteenth day, and was preceded by a symptomless period. No streptococci were found on the day after nephritis

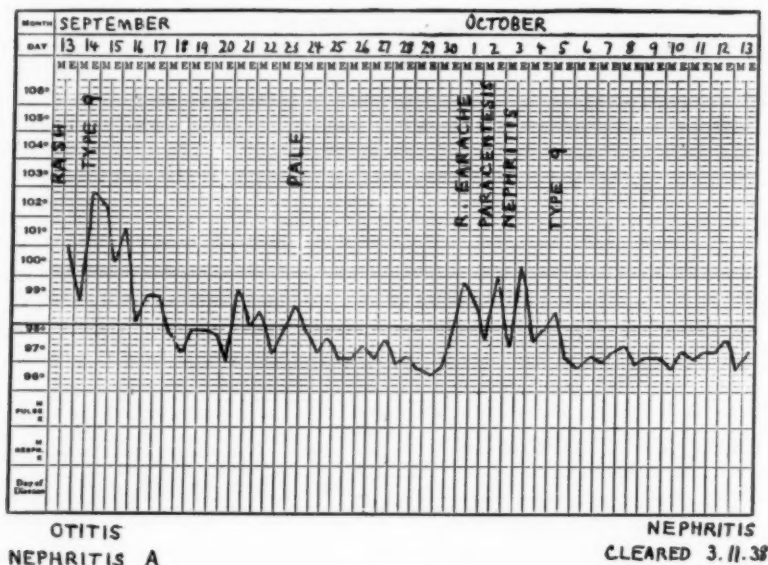


CHART II.

appeared. Immediately preceding the onset of nephritis the patient suffered from headache, adenitis and sore throat, with a rise of temperature. The tonsils were unhealthy.

CHART II.—Chart II is from a case of nephritis (Class A). Again nephritis appeared on the nineteenth day, but the silent period was not entirely symptomless. In this class hard enlarged cervical glands, with slight rises of temperature, enlarged tonsils that are often spotty or obviously infected, and pallor are the symptoms; these are almost constant. In the case from which Chart II was taken right-sided *otitis media* occurred on October 1. There was no change of type (Type 9), and the occurrence of otitis at this time may have been accidental.

CHART III.—Rheumatism appeared on the fourteenth day. Note the shorter silent period. After an interval of a few days rheumatism reappeared with articular swellings, and the development of a soft systolic murmur was noted. This disappeared three weeks later. Such temporary murmurs are common.

CHART IV.—Rheumatism appeared dramatically on the fifth day following an attack of acute tonsillitis. This tonsillitis appeared on the fourteenth day after



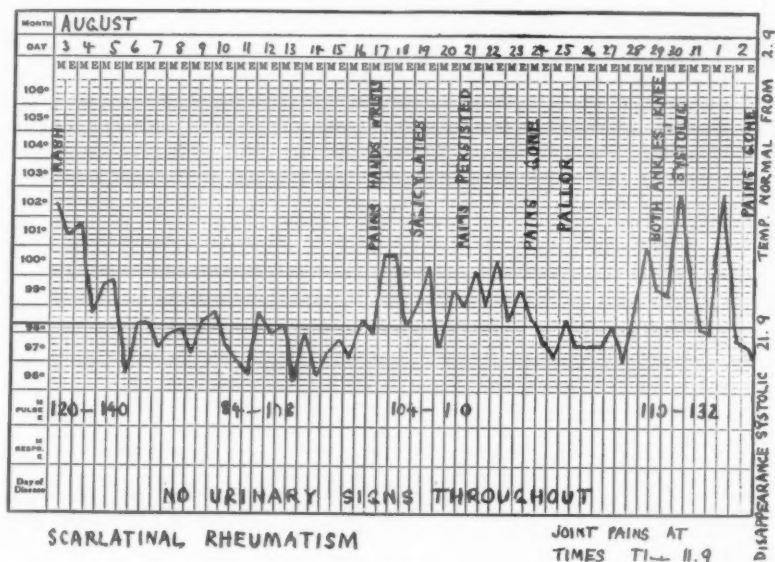


CHART III.

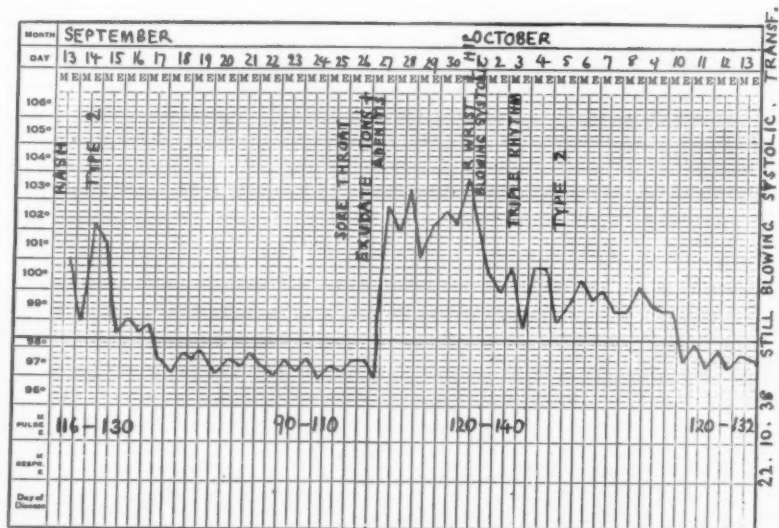


CHART IV.

the scarlet fever rash. There was no change of type (Type 2). The carditis persisted and signs were unchanged three weeks later when the patient was transferred to another hospital.

We have all seen cases of nephritis, rheumatism and adenitis occurring in persons from whom the faucial tonsils have been completely removed, any lighting up of naso-pharyngitis being sufficient as an exciting cause in the proper subject. But in my opinion this does not entirely exclude the faucial tonsils from guilt. Indeed, the very fact that they had been removed suggests a previous and probably primary infection there. I am bound to say that in my experience the faucial tonsils have in the vast majority of cases been present and in most of them obviously infected.

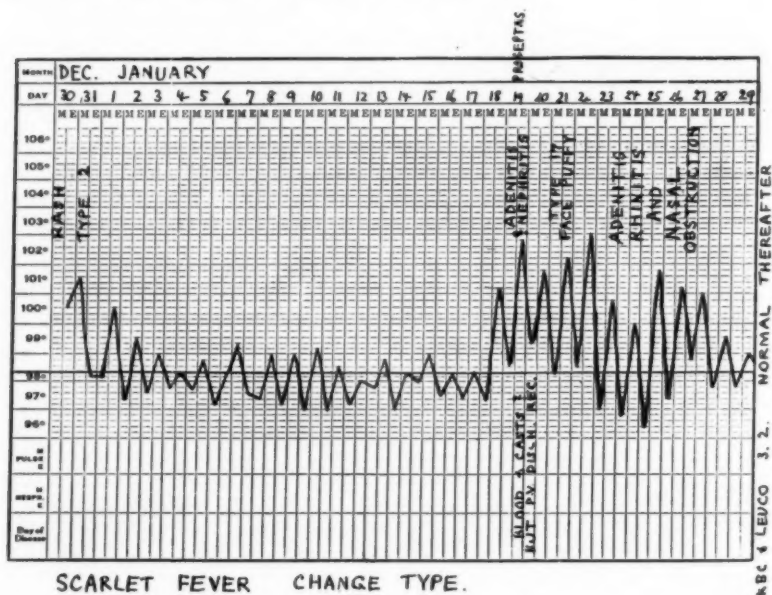


CHART V.

So long as the tonsils are doing their work efficiently, as protective and immunizing agents, it is most desirable that they be retained, and this surely applies particularly to children up to the age of nine or ten. But when the policeman has been captured by the enemy or, worse still, used as a means of entry, he must be removed. That, I take it, is the ordinary criterion in ordinary subjects. But when we consider that the children who develop nephritis or rheumatism are not ordinary, in that they seem to have difficulty in dealing in a normal way with infection or with the by-products of bacteria, the question is whether we should adopt exactly the same criteria.

In the case represented by Chart II, in which the tonsils were grossly infected and likely to remain so, I consider removal of tonsils and attention to other parts of the respiratory tract requiring it to be the proper treatment,

to be undertaken as soon as the throat becomes quiet. It might be argued that, if this is an abnormal child, such surgical treatment, though it removes the main foci, might not give satisfactory results because the patient will still be liable to danger from any subsequent naso-pharyngeal infection. Nevertheless, I think it should be done.

In Case I (Chart I) the throat cleared after the primary infection and remained clear during the latent period. A slight sore throat heralded the onset of nephritis, and there was no recurrence up to the date of the patient's discharge from hospital. But one may take the view that recurrences might have appeared and/or a lighting up of the kidney symptoms. Should or should not the tonsils have been removed on or about October 10, say? In this particular instance it would appear that removal was unnecessary.

In Case III the removal of tonsils should be seriously considered, and personally I would advise it.

In Case IV the recurrence of follicular tonsillitis within a fortnight was followed by an acute rheumatic attack five days later, and almost immediate carditis.

It is more particularly on the question of tonsillectomy that I should like your advice. My own observations have led me to believe that, speaking generally, we should answer the question in each individual case just as if no rheumatism or nephritis had occurred; that is, that the presence of these complications neither adds greatly to nor subtracts from the indications for surgical treatment. It is dangerous to form conclusions hurriedly, but in more than one fatal case I have regretted that the opportunity had not been taken during a quiet period, while at the moment I cannot recall any in which the immediately subsequent course, favourable or unfavourable, has given cause for regret that the operation had been performed.

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## SOME EXPERIMENTS ON NERVE REGENERATION.<sup>1</sup>

By BASIL KILVINGTON.

(From the Walter and Eliza Hall Institute, Melbourne.)

THE results of simple primary suture after nerve division are frequently disappointing, and though anastomosis has been successful experimentally, it has not been correspondingly useful in the surgery of nerve injuries. Since the early years of this century but little experimental work has been directed towards the study of regeneration after simple division and suture of nerves and after nerve anastomosis. The experiments reported here have been carried out with a view to clarifying some of the difficulties of nerve suture and explaining the poor results which unhappily so often follow well planned surgical procedures. They are concerned with the aberrant growth of regenerating fibres after simple division and suture and after anastomosis, and with the branching of nerve fibres which further complicates the disarrangement of the pattern in the trunks of regenerating nerves.

### ABERRANT GROWTH OF EFFERENT FIBRES DOWN EFFERENT PATHS AFTER DIVISION AND SUTURE OF THE SCIATIC NERVE.

The sciatic nerve of the cat is composed of two trunks which lie side by side, bound together by areolar tissue. These separate just above the

level of the knee joint as the internal and external popliteal nerves. In these experiments the sciatic nerve was cut across above the bifurcation and at once sutured with three strands of fine non-chromicized catgut, care being taken to preserve the alignment of the nerve and to avoid axial rotation of either cut end. Five to six months later, when good clinical recovery of function had occurred, the nerves were exposed and tested with a weak faradic current. The muscles of the limb contracted strongly when the main trunk was stimulated above the suture line. The external popliteal nerve was now divided transversely above and below the suture line (Figure I, at B and C). In making the upper section the nerve was easily separated from the internal popliteal in the main trunk. Stimulation of the

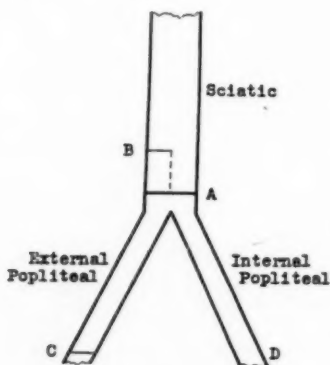


FIGURE I.

peripheral end of the external popliteal at B now caused flexion of the toes and extension at the ankle, movements normally innervated through the internal popliteal nerve. Stimulation of the central end of the external

<sup>1</sup> Accepted for publication on October 19, 1939.

popliteal nerve at C (Figure I) also caused flexion of the toes. Stimulation of the external popliteal of the other hind limb, in which no previous operation had been performed, after section at corresponding levels caused no contraction of muscles.

These observations showed that in the course of regeneration some fibres of the external popliteal nerve had grown down the internal popliteal path and that some fibres of the internal (or external popliteal) nerve had divided, branches passing down both nerves. That the place of division was the region of the original section at A was confirmed by stimulation after repeated transverse sections of the external popliteal nerve from B, to the suture line at A, and below it. The response (due to fibre division) ceased only when the nerve was stimulated distal to A.

In other experiments after similar section and suture of a sciatic nerve, a similar period being allowed for regeneration, secondary section of the external popliteal trunk was performed at B (but not at C) and good responses were obtained to faradic stimulation of the peripheral end of the cut external popliteal and of the remainder of the sciatic. Fourteen days were then allowed for secondary degeneration. It was now found that stimulation of the external popliteal nerve at B caused no response of any kind, but that after the internal popliteal was cut at D stimulation of the sciatic nerve above the suture line caused vigorous extension of the toes through the fibres which had crossed over into the external popliteal nerve, the normal flexion of the toes through innervation by the internal popliteal having been eliminated by section at D.

#### ABERRANT GROWTH OF EFFERENT FIBRES DOWN AFFERENT PATHS AFTER NERVE ANASTOMOSIS.

In these experiments the central end of a large muscular branch of the anterior crural nerve was anastomosed to the peripheral end of the divided internal saphenous nerve. The central end of the latter was cut short and a piece of the *adductor longus* muscle was sewn over it to prevent regeneration along the normal path (Figure II).

The internal saphenous nerve normally contains no efferent motor fibres, as was demonstrated in the following control experiments. In one experiment the fifth and sixth, in another the sixth and seventh, and in a third the fourth, fifth and sixth lumbar anterior roots were cut on one side. Fourteen days were allowed to permit of degeneration, and the corresponding internal saphenous and anterior crural nerves were excised and stained with osmic acid. No degenerated fibres were found in the internal saphenous, but many were present in the anterior crural nerve.

In four cats the anastomosis described above (Figure II) was performed on one side, and a little more than a year was allowed for regeneration to take place. The fourth, fifth and sixth anterior lumbar roots on the corresponding side were now cut, and eight days later the anastomosed internal

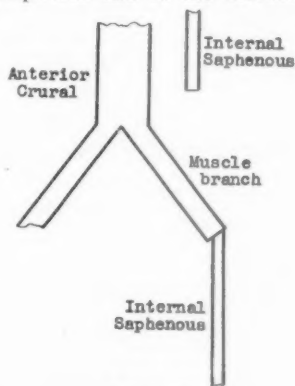


FIGURE II.

saphenous nerve was excised, stained with osmic acid and examined microscopically (Figure III). In one of the experiments approximately 30% and in the remaining three 50% of the fibres showed secondary degeneration which was traced from 13 to 16 centimetres below the anastomosis. In one experiment degenerate fibres were followed as far as the internal malleolus, where terminal branching of the nerve occurred. The regenerated internal saphenous nerve was



FIGURE III. Photomicrograph of teased fibres of the internal saphenous nerve stained with osmic acid. The preparation was made a year after anastomosis to a muscular branch of the anterior crural and fourteen days after section of the anterior spinal roots.

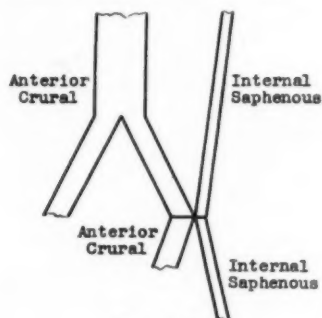


FIGURE IV.

also observed to be much thicker than the normal nerve in the opposite limb.

In another series of experiments the central end of a muscular branch of the anterior crural and the central end of the divided internal saphenous nerve were sutured together to the peripheral end of these nerves, as shown in Figure IV. Though their old peripheral paths were still open to them, some efferent fibres from the anterior crural were still found to have grown down the internal saphenous nerve.

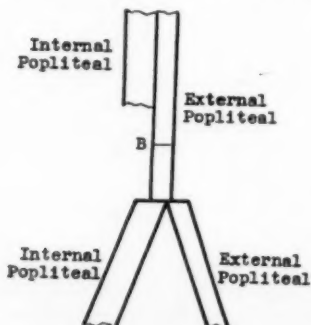


FIGURE V.

#### THE BIFURCATION OF NERVE FIBRES AT THE SITE OF ANASTOMOSIS.

An attempt has been made to provide evidence of branching at the site of anastomosis by suturing the cut central end of a single nerve to the peripheral ends of the same and of another nerve. After time had been allowed for regeneration, secondary section of the single nerve above the anastomosis was performed. After ten days had been allowed for



degeneration, the number of degenerate fibres in the single nerve above the anastomosis and in the two nerves below it were estimated. For this purpose a sciatic nerve was cut across at its bifurcation, the central cut end of the external popliteal trunk being sutured to the peripheral cut ends of the internal and external popliteal nerves (Figure V) and about 2.5 centimetres of the central part of the internal popliteal trunk being excised. After six months regeneration had taken place down both trunks distal to the anastomosis, but the function of the limb was imperfect, the animal walking with its limb bent back in the position of dorsiflexion of the ankle. Table I

TABLE I.  
*Counts of Fibres Above and Below the Site of Anastomosis.*

Above Anastomosis. External Popliteal.	Below Anastomosis.		
	External Popliteal.	Internal Popliteal.	Total.
1,399	1,477	3,962	5,439
3,049	1,880	2,655	4,535
2,650	1,578	2,133	3,711

shows the counts in three experiments of degenerated fibres obtained ten days after secondary section of the external popliteal nerve above the anastomosis at B in Figure V. The table shows that the total number of fibres in the two trunks below the anastomosis is greatly in excess of the number of fibres in the single nerve above it. The fibres in the external popliteal must therefore have branched during regeneration to supply both trunks. In some experiments fibres from the cut central end of the internal popliteal nerve were shown by electrical stimulation to have grown across the gap into the internal popliteal nerve at the anastomosis. The experiments were discarded, except the last experiment in Table I, in which a few such fibres were detected, but which were included in the count with those of the external popliteal above the anastomosis and do not invalidate the result. There is a considerable margin of error in such counts, but its chief source is underestimation of the number of fibres in the trunks below the anastomosis, since many of these are extremely small. In the nerves below the anastomosis there were numerous areas in which no fibres were observed. It will be noted that there is great variation in the ratios between the number of fibres above and below the anastomosis, which may possibly be related to the variation in the amount of scar tissue and in the accuracy with which the ends were sutured.

Figures VI and VII illustrate the appearances of transverse sections of the external popliteal nerve below the section at B (Figure V) and of part of the internal popliteal nerve below the original anastomosis. It will be noted that the degenerate fibres in Figure VI are mainly of large size, though there are a few small stained globules, many of which probably represent small sized degenerate fibres. Some may represent larger fibres in which the stained globule has shrunk to one side of the sheath, and the appearance of stained circles which somewhat resemble undegenerate fibres cut transversely, may also be due to shrinkage of degenerate material to the side of the sheath. This explanation of the appearances is supported by the presence in the section of a number of degenerate fibres showing transitional appearances.

Figure VII shows that there are considerable areas inside the nerve bundles and where the black points of the myelin sheaths lie in areas of amorphous material and where fibres have apparently failed to grow. Some of the fibres are large like the majority of those in Figure VI, but there are very many more small fibres, some of which are very small and have no counterpart in the degenerated nerve above the anastomosis. These are probably fibrils from division of fibres at the anastomosis.

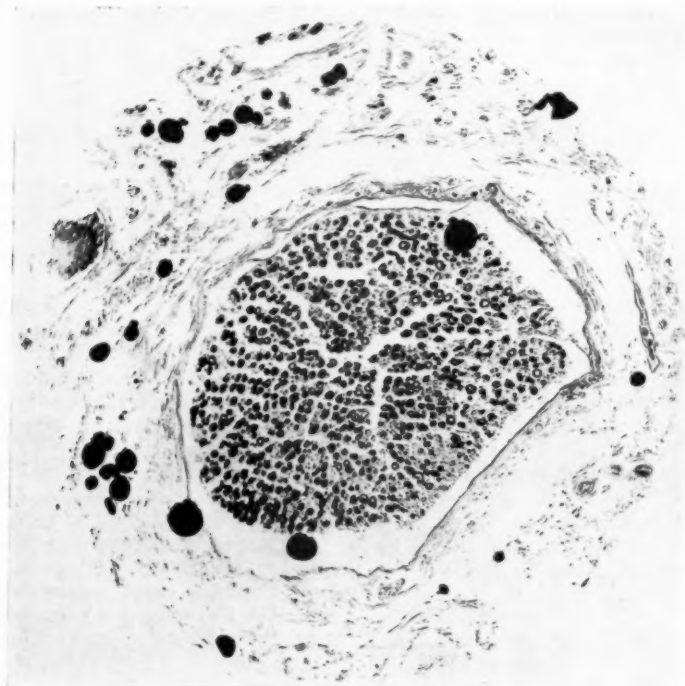


FIGURE VI. Photomicrograph of a transverse section of the external popliteal nerve above the line of suture to the internal and external popliteal nerves (Figure V), but below secondary section performed at B nine days earlier. The section was stained with osmic acid.

Division of a nerve of any size is a serious injury because recovery, even under optimum conditions, that is, primary suture and strict asepsis, is never complete. The causes of this partial failure are threefold. (i) Some fibres do not make any connexion at all with any distal fibres; they either grow out into surrounding tissues, particularly if the apposition has not been accurate, or do not get through the scar tissue at the site of injury. (ii) Some fibres do not make suitable peripheral connexions, for example, motor fibres growing down sensory paths. (iii) Some fibres grow down tracks originally occupied by fibres with similar function, but the pattern is different, and fresh central adjustment is necessary. It may well be that very few fibres take up their exact original function. The distortion of nerve pattern

which is always present, is greatly increased when the original axis of the nerve trunk is disturbed and a slight twist is given in suturing. These conditions make cortical reeducation after nerve division very difficult and often impossible.

In partial nerve division the extent of immediate loss of function is determined by the site of the lesion with reference to the emergence of the branches supplying particular muscles. Langley and Hashimoto<sup>(1)</sup> showed that there is an internal nerve plexus in nerve trunks similar to the well

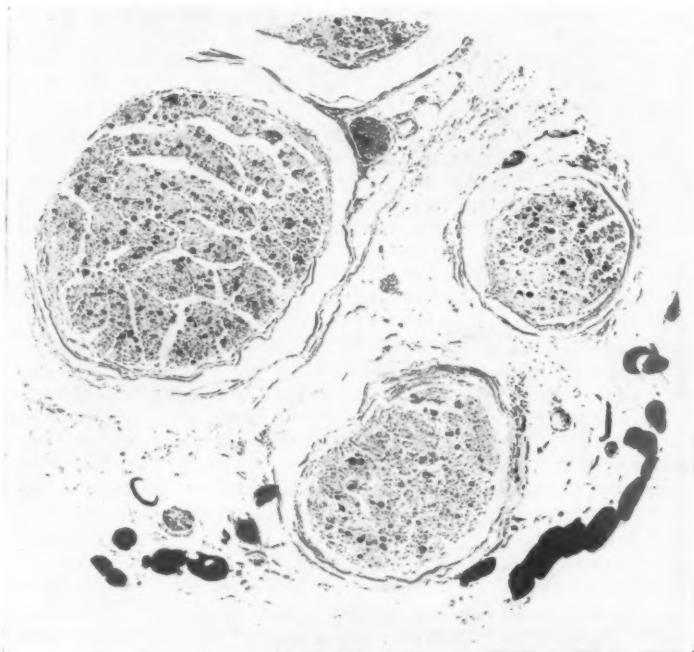


FIGURE VII. Photomicrograph of a transverse section of several fasciculi of the internal popliteal nerve below the anastomosis nine days after secondary section. The preparation is from the same experiment as Figure VI and photographed with the same magnification.

recognized plexuses such as the cervical and brachial. By this means the arrangement of fibres takes place in the nerve itself, so that if this is partly divided some distance above the origin of a branch, no absolute paralysis, but only weakness of muscles supplied by the branch, occurs. If partial nerve division has occurred close to the origin of the branch, the paralysis of the muscles supplied by it is complete. In this case suture of the gap in the nerve should be done to prevent scar tissue coming in from outside.

The confused arrangement of regenerated fibres which may result after simple division and suture, is illustrated in the experiments reported here. Some efferent fibres may grow down sensory paths, and it is probable, though no evidence has been presented to show this, that regeneration of

afferent fibres may take place along efferent paths. It is of interest in this connexion to recall that Langley<sup>(2)</sup> showed that fibres of the cranial autonomic nervous system could make connexion with sympathetic cells. Some fibres are unable to regenerate at all, probably owing to the interposition of scar tissue which is always present in greater or less amount, and which is especially marked where non-absorbable sutures, like silk, have been put in the nerve substance instead of in the sheath only, or where there has been sepsis. Evidence that bifurcation of regenerating efferent fibres may further complicate the end results of regeneration after anastomosis, has been provided by counts of the numbers of fibres above and below the suture line.

It is well recognized that the results of primary suture are disappointing in nerves controlling delicate movements, such as the ulnar. More satisfactory results follow suture of nerves concerned with gross or coarse movements, for example, extension of the wrist or dorsiflexion at the ankle. For coarse movements slight alterations in the nerve pattern are not vital. Nerve anastomosis has never become popular, though in laboratory animals it often succeeds. There are two reasons for this. Usually it is not considered till paralysis of a muscle has existed for some time, and the inevitable alteration of pattern and the possibility of imperfect regeneration in the reinforcing nerve entail the risk that the last state of the patient may be worse than the first.

In facio-hypoglossal (or spinal accessory) anastomosis, where the whole or a large part of the relieving nerve is used, recovery frequently takes place, provided that the operation is performed while the facial muscles are still viable. The patient in these cases can voluntarily close the eye or move the face, but those that I have studied tell me they do so by making an effort to move the tongue. An emotional movement of the face suddenly called on, such as a laugh, allows the full paralysis of the face to be evident; cortical or subcortical education has not occurred.

In infantile paralysis nerve anastomosis has never been very successful. It is usually attempted only after relaxation and reeducation have been given extended trial and have failed and the muscles involved have undergone atrophy. A small healthy nerve cannot supply sufficient useful fibres to a large degenerate one, for apart from distortion of pattern the small fibrils branching from a single axis cylinder do not appear capable of providing useful function.

In nerve suture three vital principles have to be observed:

1. The strictest aseptic technique should be followed. Infection is likely to provide a barrier of scar tissue which may prevent any recovery of function whatever.
2. Only absorbable sutures of plain catgut should be used, particularly if a small nerve is involved and the suture material has to be passed through the substance of the nerve. Silk should never be used in the body of a nerve trunk, though many use it for the sheath of a large nerve.
3. Distortion of the nerve axis must be avoided at all costs. When definite strands are seen these may be joined separately if this is not carried to extreme detail.

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## CONSERVATIVE METHODS IN THE TREATMENT OF HYDRONEPHROSIS.<sup>1</sup>

By RICHARD C. S. HARRIS,

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HYDRONEPHROSIS in all stages, with the varying signs and symptoms presented, is the most protean of all surgical diseases of the kidney that are met with in urological practice. Hydronephrosis may be briefly and adequately defined as an obstructive nephropathy.

It is not my intention to enter upon a theoretical discourse on hydronephrosis, either from the point of view of its aetiology or of its treatment, but rather to detail from my experience some points which I think are of outstanding practical importance in the treatment of some selected cases of different types of the disease.

Until comparatively recent times, the treatment of expediency has been the removal of the offending organ, but the past ten years have seen a complete alteration in our outlook and in our methods. It was not until the works of Waltman Walters, of the Mayo Clinic, were published that the possibilities of plastic surgery on the pelvis and uretero-pelvic junction were fully appreciated.

The work of Mr. Leon Jona, of Melbourne, on the pharmacological action of drugs on the kidney and ureter, and of Mr. Norman D. Royle, of Sydney, induced the late S. Harry Harris and myself to experiment on laboratory animals with a view to obtaining further information on the physiology of the neuro-muscular mechanism. This led to the adoption of the technique of pyeloscopy as a routine procedure, and so we were enabled to formulate definite diagnostic signs of excessive renal sympathetico-tonus as a cause of upper urinary obstruction. The elaboration and the description of the technique of renal sympathectomy were the natural sequence.

The profession is indebted to Hunner for his bringing to "general realization the importance of ureteral abnormality". This gave the lead to the more general adoption of ureteric dilatation as a means of relieving and of curing an extraordinarily large number of hydronephroses due to ureteric obstruction of varying grades of severity.

It will be impossible to outline more than briefly the various methods of overcoming this obstructive uropathy. I propose to describe the means of diagnosis employed and the method of estimating and of carrying out the appropriate treatment in a few selected types of hydronephrosis.

<sup>1</sup> Accepted for publication on April 15, 1939.

As previously defined, the cause of hydronephrosis is obstruction to the urinary stream. This may occur at any level along the course of the excretory ducts, and may be intrinsic, extrinsic or neurogenic. It is the general rule that when the obstruction occurs at the upper levels, the hydronephrosis will be of the pelvic type (that is, gross dilatation will be found to have taken place at the expense of the pelvis of the kidney, whilst the calyces are relatively small). When the obstruction is in the lower end of the ureter, on the other hand, or when the outflow of urine from the bladder is impeded, generalized dilatation of the calyces, pelvis and ureter above the level of the obstruction, with thinning of the renal cortex, is the picture that is presented. Intermediate types between these extremes are common. Beyond this generalization I do not propose to go, and I shall confine my remarks to some of those conditions which are amenable to conservative methods (namely, ureteric dilatation, renal sympathectomy, and plastic or reparative surgery).

As a means of diagnosis, a complete urological investigation is essential. Excretion urography should be a routine procedure. A differential renal function test should be performed during cystoscopic investigation, and of those in common use I prefer and rely upon implicitly, as a test of surgical efficiency, the excretion of indigo-carmin. The urine from each kidney and from the bladder should be collected for pathologically examination and for report, and pyeloscopy and pyelography, unilateral or bilateral, as the individual case demands, should be carried out. It is also of the greatest value to obtain a picture demonstrating the rate of emptying (that is, the emptying time) of the renal pelvis. As was pointed out by Leguen, the normal rate of emptying, when a watery opaque medium has been employed, may be regarded as approximately one cubic centimetre per minute (that is, if ten cubic centimetres have been injected into the pelvis, ten minutes after removal of the catheter there should be little or no evidence of the presence of any of the opaque medium). Any gross outlining of the pelvis or calyces may be regarded as evidence of retention. The stage of obstruction may be estimated, in part, by the density of the shadow of the retained medium.

By means of this complete routine, definite knowledge as to the degree of hydronephrosis is obtained, and the site and nature of the obstruction may be demonstrated or inferred. We are thus in a position to prepare a rational plan of attack.

I believe that many of the minor degrees of hydronephrosis will respond satisfactorily to ureteric dilatation, even when some extrinsic cause is present. In the early stages of intrinsic obstruction the results obtained by gradual dilatation of the ureter with Braasch bulbs of increasing size, up to a maximum number of 15 millimetre French, have been uniformly satisfactory. The procedure that I have adopted is to introduce progressively larger dilating bulbs, one, two or three at each sitting, depending upon the degree of difficulty which is encountered in overcoming the obstruction, and upon the amount of hæmorrhage so caused. The number of treatments may be as few as three or as many as six, repeated at intervals of from ten to fourteen days. It is also advisable, as a final check-up, to perform one additional dilatation after an interval of about six weeks to ensure that the contraction has not recurred. This recurrence in my experience has been a rarity, though occasionally, to complete the cure, it may be necessary to perform a ureteric dilatation at six-monthly intervals for two or three years.



In the grosser types of hydronephrosis, the functional power of recovery of the kidney must be estimated before any plastic procedure is undertaken. The placing of a ureteric catheter, of size from number 8 to number 10, within the renal pelvis and maintaining it in this position for a period of up to two weeks will give valuable information on this power of renal recovery.

Despite the theory of renal counterbalance which was formulated by Hinman and Lee Brown, clinical experience has shown that this recovery may occur to an amazing degree, even in the presence of a normally functioning kidney on the opposite side.

The elimination of infection, which is essential to any type of plastic surgery, is generally possible by the lavage of the renal pelvis with a silver nitrate solution through the inlying catheter, and by the use of appropriate urinary antiseptics given by mouth. Occasionally, where it is impossible to eliminate this infection sufficiently, and in those cases in which for various reasons nephrectomy is contraindicated, a temporary nephrostomy is the rational method of treatment. In some, more particularly in those cases in which the obstruction is due to an inflammatory extrinsic cause, this treatment alone, if persevered with for a reasonable period, will allow the absorption of the inflammatory tissue, and will result in the relief of the obstruction.

There is a type of case to which I should now like to refer more fully, in which no anatomical obstructive cause can be found, but in which renal pain of varying grades of severity and varying amounts of pelvic retention are intermittently present. I refer to renal sympathetico-tonus.

The outstanding diagnostic features may be summarized briefly as follows: renal pain, confined to one side only; recurrence of pain after its temporary relief by eserine, of which more later; urinary stasis, involving the pelvis and calyces in whole or in part and, less frequently, a sustained knee jerk on the side of the lesion; and, finally, the absence of any demonstrable cause of organic obstruction. Occasionally the absence of organic obstruction at the uretero-pelvic junction will have to await final verification at the time of operation.

In the advanced stages of sympathetico-tonus, when a secondary organic obstruction may have developed at the uretero-pelvic junction, the primary lesion may very easily be overlooked, and it is probable that the failure to perform renal sympathectomy concurrently with a plastic operation may be the cause of some of the unsuccessful results that have been reported.

The operation of renal sympathectomy, introduced and carried out by my late brother and by myself, has presented no great technical difficulties when the salient features of its practice are fully appreciated. Of these, perhaps the most important is the stripping of the vessels of the renal pedicle in an outward direction (that is, towards the kidney itself). Further, if the vessels are placed on tension, by the introduction of the fingers of the left hand behind or in front of the pedicle, as may be indicated during this stripping, complete control of hæmorrhage is assured. Should bleeding of any severity be encountered, it is a simple matter to pick up the bleeding point with fine curved forceps, and to ligate it with fine silk, which we have found has considerably less tendency to slip than catgut.

It is also important to remove completely from the pelvis and uretero-pelvic junction all surplus tissue and to divide the superior ureteral sympathetic nerve supplying the upper portion of the ureter. It will be

found that when the operation has been completed, the kidney is anchored solely by its stripped pedicle and by the ureter. The hypodermic injection of one one-hundredth of a grain of eserine sulphate at this stage, by promoting deep regular contractions of the pelvis and ureter, will demonstrate that complete sympathetic denervation has been accomplished.

I should like to turn now to plastic operations upon the pelvis and upon the uretero-pelvic junction, and it is in this particular province that the greatest advances of recent years have occurred.

So many different methods of performing these plastic procedures have been described that one has a rather wide choice, and in practice it will be found that many variations will be necessary to meet the particular condition encountered. There are, however, three salient principles which appear to be universally accepted by those who have had experience of this work. The first is the introduction of a splint, in the form of a ureteric catheter, traversing the newly-formed uretero-pelvic junction. The second is the provision of adequate drainage to the renal pelvis by means of a nephrostomy tube. It is my practice to remove the former after about two weeks, and the latter after about three weeks. The third principle is that infection of the kidney must be controlled before a plastic procedure is attempted, and failure to secure this adequate control is not infrequently the cause of an unsatisfactory outcome.

It appears to me that the decision to perform a plastic operation, as opposed to a nephrectomy, is mainly dependent on a number of pre-operative factors. Where the obstruction can be relieved by the introduction of an inlying ureteric catheter, information of extreme importance as to the power of the kidney to regain its function can be obtained. Failure to show this improvement in functional results after two weeks' adequate drainage seems to me to be a clear indication for nephrectomy, whilst improvement, even though somewhat diminished function is recorded, indicates that some type of plastic operation must be considered.

The amount of renal cortex that has not been eaten into by the obstructive process can be estimated with moderate accuracy by a close study of an efficient excretion urogram and by a retrograde pyelogram, and should this amount appear adequate, efforts should certainly be made to preserve the kidney, irrespective of the size to which the pelvis may have enlarged. Pelvic resection is generally an integral part of the plastic operation.

As I have previously stated, infection of the kidney can generally be overcome by pelvic lavage with a solution of silver nitrate or of mercuriochrome per medium of an inlying catheter; by the administration of urinary antiseptics (sulphanilamide or mandelic acid) and by repeated injection of eserine sulphate. When this result cannot be obtained and when the two previous criteria have been fulfilled, preliminary drainage by means of a nephrostomy will generally bring about the desired result, and a plastic operation can later be performed.

Of the different types of plastic techniques that are in general use, I have been least impressed with the results obtained from complete division and reimplantation of the ureter into the pelvis. Unfortunately, at times, this is the only procedure suitable to the pathological condition encountered, and when this appears to be necessary, unless there are some strong contra-indications, I am inclined towards nephrectomy.

A simple and, so far as I know, hitherto unpublished technique has been carried out in the urological department at Lewisham Hospital during the last few years. In its essentials it consists of a longitudinal incision through the lower portion of the pelvis, traversing and travelling about half an inch beyond the strictured area at the uretero-pelvic junction. This incision may be carried upwards along the baggy pelvis to its upper limits, and after the redundant portion has been resected, a tubular pelvis will be obtained. In the reconstruction, a "dog's ear" flap is formed, and this leaves a widely patent uretero-pelvic junction, formed at the most dependent part of the pelvis and completely excluding the previously strictured area. Drainage of the pelvis and splinting of the uretero-pelvic junction are essentials, as previously mentioned, to the success of this operation.

And now a few words about nephroptosis. That this can be a very real cause of local and general ill health is undoubted. Before surgical measures are advocated, however, it is essential that the pathogenicity of the condition be completely established. The discovery of a freely mobile kidney is not sufficient to warrant nephropexy. I hold that the following criteria must be fulfilled before surgical interference is advised. An excretion urogram must demonstrate some degree of hydronephrosis, whilst a film taken with the patient in the vertical or approaching the vertical position must show an unusually large range of excursion of the kidney and some angulation of the ureter. At cystoscopic investigation a pain reproduction test (that is, filling the pelvis with fluid until discomfort is registered) must reproduce the type of pain of which the patient has previously complained. A retrograde pyelogram should reveal delayed emptying time. If these criteria are fulfilled, nephropexy, which should generally be reinforced post-operatively for about three months by the wearing of an abdominal support, will give most satisfactory and lasting results. In the milder types of this condition I think that dietetic measures with a view to increasing weight and the wearing of a properly fitted abdominal support should be tried for at least three months before surgery is suggested.

In conclusion, I trust that from the somewhat incomplete survey that I have presented sufficient has been said to stimulate interest in the fascinating study of the diagnosis of the different types of hydronephrosis and in the planning of the appropriate treatment. I feel that a policy of appeasement is frequently preferable to one of direct action, and that the reforming and rehabilitating of a kidney, otherwise condemned, is achieving something well worth while.

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## FRACTURE OF THE NECK OF THE FEMUR: PROS AND CONS OF NAILING.<sup>1</sup>

By JOHN HOETS,  
Sydney.

THE subject set down this afternoon has been discussed throughout the year almost *ad nauseam*. So much so, that I feel very diffident about speaking on it before such an audience, knowing that each one has not only read the opinions of surgeons in various parts of the world, but formed his own opinion and adopted a technique, which, if not completely satisfactory, is, he feels, as satisfactory as he can hope in his own particular circumstances. I shall therefore state my own position as briefly as possible.

When, some three and a half years ago, the meeting of the British Medical Association was held in this city, Professor Hey Groves was emphatic on several points. Firstly, he believed that the method of dealing with fractures of the femoral neck most likely to result in bony union was that which employed the Smith-Petersen nail; but, secondly, at that time he would have nothing to say in favour of any operative procedure but that of open reduction and introduction of the nail under visual control. Therefore, he was driven to the conclusion that the Smith-Petersen nail, although the method of choice, was to be used only in favourable circumstances; that is, only in the treatment of those people who were young enough and strong enough to stand the method he advocated. The very old and feeble were excluded from its benefits.

I myself, amongst others, agreed with his first conclusion, that is, that the Smith-Petersen nail offered the best prospects of securing bony union; but held that the method introduced to Australia by Mr. King, of placing the nail, after accurate reduction of the fracture, all under X-ray control with a minimum of operative trauma, was accompanied by so little shock that it was particularly applicable to the old and feeble, and even in extreme degrees of weakness and senescence, gave the patient a chance of bony union with a minimum of discomfort during convalescence. If, on the other hand, old age or other disease proved fatal, the fracture, once fixed, ceased to be a cause of pain and difficulty in nursing.

Since that meeting Professor Hey Groves has so far altered his opinion that he has advocated a method of introducing the Smith-Petersen nail without even X-ray control, relying on anatomical landmarks and a mechanical introducer. I find myself still satisfied with the method and results then stated.

From the welter of argument and statistics, certain facts emerge which seem to be definitely established. Firstly, fractures of the femoral neck are

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now expected to be followed by good bony union in a large proportion of cases. Secondly, by whatever method such a fracture is treated—Whitman's plaster, Smith-Petersen nail, or any other—the essential common factors necessary for success are good reduction, followed by adequate fixation until union occurs, just as in any other fracture. Thirdly, although a good result may follow even no treatment—that is, just the use of sandbags or nothing at all—consistently good results may be expected only when each fracture is dealt with under X-ray control; and before any fixation is applied, either by plaster externally or nail internally, reduction must be accurate as shown by X-ray pictures taken in two planes.

I believe the Smith-Petersen nail offers advantages which the Whitman method lacks. In the young and robust, I believe that equal results may be obtained by the two methods. The younger a patient, the more inclined I am to use the Whitman method. On the contrary, the older the patient, and the more debilitated, the greater the need for nailing.

As to the technique of the operation, time will not permit of any detailed discussion, but I may say that I have found no reason to depart from that described by Mr. King except in minor details. The one essential is X-ray control. The better the X-ray service, the less time the operation takes up to a point; but even when the time is prolonged to two hours, the patient does not suffer, as he is for the greater part of the time just asleep and suffering no shock-producing manœuvre.

For this reason I have generally used and strongly advocated a general anæsthetic in place of spinal or narco-local anæsthesia. For a nervous and feeble old person, the strain of having the operation done while conscious is too much. He needs the oblivion of a general anæsthetic of some kind. I find that "straight ether" leaves little to be desired.

Beside the Smith-Petersen nail and Whitman's plaster, mention must be made of another method, namely, Lorenz osteotomy, or, as one often hears it called now, the McMurray osteotomy, since McMurray has advocated its use even as the routine treatment. The contention on which this advocacy rests is that it is practically always followed by a sound stable hip with very little shortening, and limitation of movement not sufficiently marked to interfere very greatly with the degree of activity required at the age in which this fracture occurs.

This at first sight appears a very excellent plan, and it is correct as far as it goes, but the results are obtained at the cost of open operation, followed by three months' recumbency in plaster. Granted the operation is almost devoid of shock, but the long period in plaster is to be avoided in the very old and feeble if possible. By nailing this is avoided, and when union occurs, the result is a much better one anatomically and functionally than that following osteotomy, and union does occur with nailing in a very large percentage of cases. When it fails, then the surgeon has osteotomy to fall back on, with the fairly certain prospect of a good functional result, provided the patient can stand the recumbency in plaster.

The failures with nailing will comprise a small percentage of the total patients, and among these failures there will probably be a few patients quite unsuitable on account of age or feebleness through illness, leaving a very small proportion of the total for osteotomy.

This in my practice is the place of osteotomy, and it has been, I believe, 100% successful when used; but I should be very loath to abandon the easy convalescence following nailing, with the large percentage in whom it will succeed, because some of the patients may need osteotomy later.

Much has been said and written of the evil effects of the nail itself in the hip joint, aseptic necrosis and arthritis being the main sequelæ ascribed to its use, apart from non-union allegedly due to the nail. To take the latter first: I seem to remember lots of cases of non-union before Smith-Petersen invented his triradiate nail, and cannot accept the nail as a cause of non-union. Someone has said: "The bad results of nailing are the results of bad nailing", and I believe there is truth in the statement.



FIGURE I. Skiagram of nail in neck of femur.



FIGURE II. Specimen showing nail *in situ*.

I have a patient who, for two years after undergoing a nailing operation, showed as perfect a result as one could wish (the nail was removed at about eighteen months from its insertion), and who then began to complain of pain. X-ray examination showed a picture of a somewhat flattened head with irregular decalcification—aseptic necrosis.

About the same time I had under my care a seaman who fell between his ship and the wharf, sustaining a severe trauma without fracture of his hip. Some eighteen months after the accident his skiagram showed almost identical changes. In the latter case the trauma undoubtedly caused the condition shown. My own belief is that in the former the same cause was responsible; that is, trauma at the time of fracture, and not the nail.



Arthritis so often appears in the hip joint that it is to my mind not logical to ascribe it to the careful insertion of a Smith-Petersen nail when we find it following any one of numerous known traumata and, more frequently still, without any single trauma sufficiently great to be remembered.

In conclusion, I shall quote one case which exemplifies beautifully the value of the Smith-Petersen nail in subcapital fractures of the femur.


M.S., aged sixty-three years, was admitted to Lewisham Hospital with a fracture of the femoral neck. Her general appearance was that of a woman much older than her stated age. Her condition was so obviously serious that it was doubtful whether she would stand even the nailing. However, Dr. Leo Flynn in consultation agreed that she could not last more than a few days unless something was done, as she was suffering considerable pain and nursing was extremely difficult.

She stood the nailing quite well and was immediately comfortable. She sat up in bed and was nursed without complaint. She was able to be lifted to an armchair and sat comfortably. Her temperature fell and her condition improved. On the twelfth day after operation she complained of pain in the feet, and senile gangrene manifested itself. Both feet became affected, a line of demarcation showing about the mid-tarsus. She was returned to bed, developed an extensive bed sore, and gradually petered out, dying as the result of vascular degeneration four months after admission to hospital.

Now surely here was a case in which the failure to secure union might well be expected. In spite of the patient's death, the nail had done all that could be hoped. Pain had been abolished from the fracture site, nursing had been made easier, and the patient's life saved for the time being, to be lost four months later.

A post-mortem specimen was obtained, which I ask you to examine. You will notice that although the patient's arteries were too degenerated to keep her alive, they were able to produce bony union. Note the perfect trabeculation of the head in the neighbourhood of the fracture line, which is hard to find. When the nail is withdrawn, note the texture of the walls of its track.

Remembering that this woman was old, feeble and in such a low state of health that she died with senile gangrene of both lower extremities, and seeing this specimen and its skiagram (Figures I and II), will one ever be able to say that a patient is too old or feeble for a fracture of the femoral neck that is treated by a Smith-Petersen nail to be followed by firm bony union?



## CHRONIC LARYNGEAL AND TRACHEAL STENOSES.<sup>1</sup>

By GEORGE SWINBURNE,  
*Melbourne.*

BEFORE Ludwig von Schrötter published his results in 1875 and described his methods of treatment for chronic laryngo-tracheal stenosis, every patient so afflicted was considered incurable. The instruments he used were tin bolts and hard india-rubber tubes.

In 1885 O'Dwyer introduced the method of intubation, and in 1890 Lefferts described an improved intubation tube. In 1911 Thost described metal bolts, and later Mikulicz used glass tubes.

In the early part of this century the English school, including Tilley, Dundas Grant and St. Clair Thomson, considered that when the larynx was involved there were stenosis and ankylosis of the arytenoid region, that no treatment was of any use, and that it was preferable to leave the patient with a permanent tracheotomy tube.

Negus<sup>(5)</sup> in a recent paper expressed the opinion that a permanent tracheotomy tube had many advantages in practice. There is only one risk, and that is the danger of drowning if the neck is submerged in water. He also made the proviso that some airway must be present for purposes of voice production. The cannula used has a hinged valve so that the air can enter on inspiration and part or all can pass out through the larynx on expiration. Negus uses this for the following classes of patients: (a) those who are unable to separate their cords because of fixation of the crico-arytenoid joints; (b) those with permanent double abductor paralysis; (c) those with healed lupoid or tuberculous laryngitis or a healed malignant larynx, because of the danger of causing a recurrence; (d) those with certain severe stenoses in which there is a contraindication to curative treatment present or when there is collapse due to loss of the cartilaginous framework of the larynx.

But, except for the above special classes of stenosis, the results of Schmiegelow,<sup>(6)</sup> of Copenhagen, and Chevalier Jackson,<sup>(2)</sup> of Philadelphia, have shown that this condition is not incurable, and that the patients should be given an opportunity of avoiding the inconvenience of a permanent tracheotomy cannula.

In speaking of stenosis of the larynx, which means a narrowing of the laryngeal airway of any degree to complete atresia, the term "chronic" is usually applied to a stenosis due to scar tissue. Sometimes pure tracheal stenosis occurs, and if it involves both, it is known as laryngo-tracheal stenosis.

<sup>1</sup> Accepted for publication on May 17, 1939.

### ÆTIOLOGY.

Any disease or injury of the larynx may result in stenosis. If the condition is not inflammatory at first, secondary infection with ulceration on healing will produce fibrous tissue, which later will contract and result in stenosis.

Jackson in America found that the commonest cause was the scarring resulting from high tracheotomy, accounting for 75% of all cases. In most cases the high tracheotomy was done hurriedly, in a few ignorantly, in the presence of obstruction to breathing; in many of these cases the tracheotomy had been postponed for too long. In children the subglottic tissues are peculiarly sensitive to trauma.

Jackson has classified the causes in his writings, but a few stand out as being commoner and specially worthy of notice. In the infective granulomata, for example, tuberculosis and syphilis, and the acute infectious diseases it is practically always the superadded pyogenic infections from the mouth that do the harm. Healed perichondritis will result in some degree of stenosis, and in the early stages of the development of radium and deep X-ray therapy this complication was not uncommon.

In diphtheria and very occasionally in typhoid fever a separate distinct necrotic process occurs, in which the replacement of the lost tissue by scar tissue produces the stenosis.

Jackson classifies the traumatic causes as tracheotomic, intubational, operative, suicidal or homicidal, and accidental, for example, retained foreign bodies, bullet wounds and other external violence.

### PATHOLOGY.

The actual obstruction in the laryngeal airway is composed of scar tissue. If there has been any loss of the laryngeal cartilaginous framework, a contributing element of collapse is usually present. This loss of cartilage is usually due to necrosis, following either primary disease or operative attempts at repair. A prolonged perichondritis results in scar tissue which later contracts.

In most patients who have worn a tracheotomy tube for a long time there is a mound of scar tissue on the posterior wall of the trachea, just above and behind the convexity of the tube, and this sometimes adds a tracheal stenosis to the laryngeal stenosis. Also a more marked tracheal stenosis may develop around a badly fitting tracheotomy tube and be added to a laryngeal stenosis. Congenital stenoses are usually not cicatricial in character, but in the form of a thin membranous web.

Tracheal stenosis as a separate entity does occur. Again the commonest cause is a high tracheotomy in children, often combined with scarring due to diphtheritic necrosis. It usually takes the form of a diaphragmatic web across the lumen of the trachea with a varying sized passage, often only pin-point.

Other causes of tracheal stenoses are gummata, an intrusive suppurating gland with or without perichondritis or tuberculosis of the tracheal wall.

This paper does not include within its scope stenoses due to peritracheal scars or from compression due to peritracheal tumours, such as tumours of the thyroid gland.

### SYMPTOMS.

Difficulty in breathing is the obvious symptom in patients who have not undergone tracheotomy. Patients who have developed a gradual stenosis have learned to order their lives according to their breathing capacity, and their movements are slow and quiet.

As the lumen becomes smaller there is an increased risk of the super-vention of an acute stenosis because of some inflammatory swelling of the parts following an acute infection. Death from asphyxia may result unless tracheotomy is performed.

Aphonia is common in laryngo-tracheal stenosis, but while any air at all can get through the larynx the whispered voice is not lost. In complete atresia the patient may have no voice at all, or may have developed a buccal voice. In stenosis, coughing may sound croupy or have a "brassy" whistling or wheezing sound. Stridor and wheezing, especially on inspiration, are common. In severe degrees of obstruction inspiratory retraction at the supra-sternal notch and at the epigastrium is an important sign that something should be done to relieve the condition.

### DIAGNOSIS.

Patients who come for treatment usually have an insufficient airway that is obvious, but the character of the obstruction to the airway can be determined only by local examination.

The following methods are available: (a) indirect laryngoscopy, (b) direct laryngoscopy, (c) bronchoscopy, (d) retrograde laryngoscopy, (e) tracheoscopy.

The first method is not available in young children, and in adults it must be followed by the second. If Jackson cannot pass a three millimetre bronchoscope, he may try preliminary dilatation with bougies, or if he does not think that will help, he proceeds to a retrograde examination through the tracheotomy opening.

A careful external palpation and an X-ray examination, in some cases combined with an opaque mixture, combined with the above methods, are necessary to ascertain the size, shape and character of the obstructing tissues and whether there is any loss of cartilage. The last mentioned is an important point in prognosis, which is much better if the cartilaginous framework is intact. If it is partly lost, collapse occurs, which is very hard to combat.

### TREATMENT.

Prophylaxis is very important; most cases other than the traumatic are preventable by early diagnosis; in patients needing tracheotomy prophylaxis consists of early tracheotomy below the second tracheal ring, the use of a suitable cannula, its proper care and finally early decannulation by the corking method as advocated by Jackson.

A preliminary study of every case of laryngo-tracheal stenosis is important; a study of the local conditions as outlined above and a thorough investigation of the general condition should be made. In those cases in which the stenosis is due to too high a tracheotomy, a low tracheotomy should be done, a bridge of tissue being left between the new and old sites.

There are certain contraindications to treatment—active tuberculosis, syphilis or perichondritis, or an extensive loss of the cartilaginous framework

of the larynx. Cartilage transplants have been tried, but the procedure is difficult in this situation and not very successful.

Any lowering of general health should be treated, and any foci of infection in the mouth and upper respiratory passages removed before treatment of the larynx is started.

Jackson has pointed out that in regard to treatment there are two classes of patients: adults and children.

The difference is that the larynx is of the fixed type in adults, whereas in children, under the method of treatment by partial corking of the cannula as developed by Jackson himself, great help can be expected from the enlargement of the laryngeal framework as the child grows older. This means careful, constant and regular treatment, but the results are good. Also the method is usually combined with dilatational treatment. Jackson has laid down the following principles essential to success in this method of treatment. Help by growth of the larynx in these cases is obtained only if the breathing through the larynx is forced to the utmost by corking of the cannula.

It is necessary that (a) the size of the by-passage for air must be at all times as small as the child can tolerate; (b) the by-passage must be worn night and day except during any respiratory infection such as influenza, which may produce excessive purulent secretion; (c) the child should sleep in the same bed as the mother or someone who would waken if it became restless for want of air, and who would take the appropriate steps to clean the airway.

#### *Intubational Dilatation.*

Jackson, working with Dr. Ellen J. Patterson in his early days in Pittsburgh, used increasing sizes of intubation tubes. The patient could breathe through the mouth, whisper and do light work, and there were no pulmonary complications.

Killian was the first to use an expansile rubber tube as a means of keeping the cicatricial tissue dilated while epithelialization occurred. He used it combined with a laryngostomy. It has since been used without laryngostomy by the method advocated by Schmiegelow, of Copenhagen, who performed a laryngo-fissure (or tracheal fissure if that alone was necessary), cut out the scar tissue and placed a rubber tube in the site of the stricture about five centimetres long and slightly wider than the laryngeal lumen, so that it kept up a definite pressure against the walls of the larynx. He anchored this in place by transfixing the skin, the wings of the thyroid cartilage and the rubber tube by means of a silver wire carried through by a needle. At first he used to have the wire protruding on each side of the neck and fixed by pieces of wood or metal. This proved disagreeable to the patient, so he then cut off the wire flush with the skin, at the same time pressing down the skin with the scissors so that the skin could slip back and cover the ends of the wire. Schmiegelow was using this method as early as 1910. He found it better not to start treatment before the child was five years old because of the size of the parts. He used a general anæsthetic in children and a local anæsthetic in adults. The upper end of the tube lay in the larynx above the vocal cords, but was not allowed to protrude into the pharynx; if the tube was placed too high, particles of food could get into the trachea and cause irritation, coughing and eventually infection of the air passages. Control of the position of the upper end was effected by either a finger passed through the mouth or by direct laryngoscopy.

In children he left the tracheotomy tube in position, but in the treatment of adults, when it is usually possible to introduce a large tube from the outset, he often removed the cannula directly after operation. He took the tube out by direct or indirect laryngoscopy through the mouth, the silver wire bending and coming out along with the tube.



FIGURE I. Reproduction of a lateral radiograph of the neck in the case of Miss E.T., showing diaphragm-like stricture in subglottic region. Tracheotomy tube in situ.



FIGURE II. Reproduction of a lateral radiograph of the neck after removal of stricture and anchoring of rubber tube in laryngeal airway by means of silver wire through lateral thyroid ala.

The patients usually feel more or less pain for the first twenty-four hours after operation, and swallowing is not allowed for this period, and then they try to take a teaspoonful of sterile water. Usually the patients find solid and semi-solids easier to take for the first few days. Sterile food is used until they can swallow properly.

Schmiegelow found that even when a tube had been in position for three months, it was always entirely free from incrustation. He gives records of eighteen patients ranging from one to fifty-six years of age. In seven cases fibrous diaphragmata of varying size and position were present. With the exception of three very serious cases of laryngeal stenosis in which the drain had to remain in position for six, nine and eleven months respectively, the dilatation took only from one to ten weeks, averaging six weeks. Very occasionally Schmiegelow had to repeat his laryngo-fissure and introduce a second larger tube, in one case five times.

E.T., a female, aged nineteen years, was first seen on July 25, 1938. At the age of two years she suffered from laryngeal diphtheria, for which an emergency tracheotomy was performed; this was too high up, namely, just below the cricoid



ring. A diaphragmatic subglottic stenosis followed (see Figure I), and the tracheotomy tube had been worn for the last sixteen years continuously. The patient had a whispered voice. Indirect examination showed what appeared to be a complete obstruction, but on direct examination a pin-hole opening in the stricture was seen. The level of the stricture can be judged from Figure I. On August 1, 1938, a low tracheotomy was performed. On August 15, 1938, laryngo-fissure was performed, the stricture was excised, and a rubber tube (portion of a de Pezzer catheter), just a little larger than the lumen in the region of the stricture, was placed in the trachea and larynx and anchored with silver wire after the method of Schmiegelow (Figure II). The upper level of the tube was just above the vocal cords. Seven weeks later the tube was removed from above. The tracheotomy tube was removed three weeks later. Examination at increasing intervals and gentle passing of Jackson's metal dilators, well greased, were carried out for the next two months. There then appeared to be no further necessity for further dilatation, although examination has been carried out at intervals since. The patient has a good voice, though deeply pitched.

The writer records the history of a patient treated by Schmiegelow's method, and the following points of practical importance are emphasized. Firstly, the rubber tubing must be of the very best quality, portion of a de Pezzer catheter being used. Inferior qualities contain antimony, which is very irritating to the tissues.

Schmiegelow advocates a perineal needle to draw the silver wire through. The objection to this is that the needle has to be put through threaded and drawn back. The writer used a large cutting-edge surgical needle with a good sized eye, which has to traverse the tissue only once and which worked quite quickly and well.

The silver wire needs to be hard enough to withstand the strain of violent coughing upon the tube without bending, otherwise the tube is liable to be coughed out, or breaking off through erosion may occur, when the tube will be coughed out and portion of the wire may be left in the neck. Both these events occurred in a patient who was under the care of a colleague, the second after replacement because of the first. Schmiegelow is very insistent that the tube should be above the level of the vocal cords, presumably because the upper end of the tube may press on and irritate the shelving subglottic tissues.

Finally, the writer found that in the case recorded here there were after seven weeks some incrustations on the tube, and the tube was removed at seven weeks because of the beginning odour and because of a beginning infection of the cords in contact with the tube.

Moure and Canuvt<sup>(4)</sup> used a rubber tube like Schmiegelow in conjunction with a laryngostomy. To keep the tube in place they used two silk strings, one from each end of the wound tied over a gauze pad. Schmiegelow preferred to this one his closed method with anchoring by silver wire, as he found a high frequency of pulmonary complications with the open method, possibly, he thought, partly due to the cold climate in Denmark.

#### *Dilatation.*

In the class of case to which it is suited, this method gives a high percentage of absolute cures. It is very useful in children with no loss of cartilage, especially when combined with methodical corking of the tracheotomy tube to force the growth of the larynx, as advocated by Jackson. Jackson carries out dilatation in these children without an anæsthetic of any kind, early in the morning, while the stomach is empty, to avoid vomiting

from instrumental contact with the base of the tongue. He uses his special triangular shaped metal dilators for laryngeal stenosis and ordinary tubular metal dilators in pure tracheal stenosis.

It is usually unnecessary to use dilatation after Schmiegelow's, Moure and Canuyt's or the laryngostomy method has been used. In the two last mentioned, while the laryngostomy opening is present, it would not be necessary, as a tube could be replaced if contraction began to occur during the test period following dilatation. During this period the patient wears no apparatus and is waiting to see whether the results already obtained are permanent.

In Schmiegelow's method, after removal of the tube, a careful watch at increasing intervals should be kept for the first few months, and very careful dilatation with Jackson's metal dilators, well greased to prevent any tearing of the tissues, will keep the airway patent until contraction in the new fibrous tissue in the site of the old stricture has reached its limit.

#### *Laryngostomy.*

Laryngostomy means opening up the larynx by means of laryngo-fissure and keeping it open for a long period of treatment; if it includes part of the trachea, it is called a laryngo-tracheotomy. The treatment of this method is long and painstaking. The object is to get rid of obstructive cicatricial tissue, and to obtain a lumen that is epithelialized—according to Jackson, preferably with epidermal epithelium.

The thyroid cartilage is divided in the mid-line, but the cricoid is left intact if possible; that is, unless the occlusion of the lumen is opposite it. It is preserved because it is the only complete ring in the whole airway and it helps to keep the wings of the thyroid cartilage apart.

The scar tissue is dissected out and the dilating apparatus is placed in position. This consists of a rubber tube or obturator slipped over an upward projection on a tracheotomy tube. Jackson prefers to pack the larynx with gauze, which has no loose ends, for a few days before putting in the apparatus.

The apparatus is changed every day, and when sufficient enlargement of the lumen has been obtained, a larger size of rubber tubing is substituted, until, for an

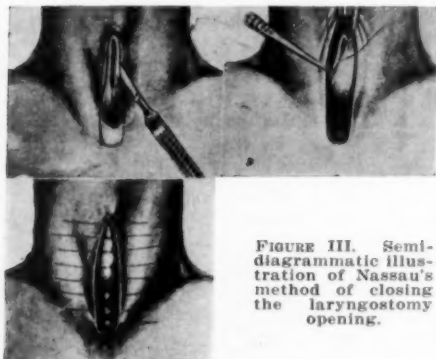


FIGURE III. Semi-diagrammatic illustration of Nassau's method of closing the laryngostomy opening.

adult, size number 45 French is reached. This is worn for six months or until a large well-epithelialized trough is obtained.

This is followed by a test period of six months, when the apparatus is left out and a large gauze pad sealed to the skin with "Elastoplast" is placed over the trough. Jackson tries this for a year, and if the condition is satisfactory at the end of that period, he performs a plastic closure by the method of Nassau (Figure III).

Post-operative complications are rare in Jackson's hands, and he attributes this to cleanliness, the avoidance of opiates and the use of general anaesthesia.

N. E. H. Box,<sup>(1)</sup> working at the Queen's Memorial Infectious Diseases Hospital, Fairfield, Melbourne, where the patient reported by the writer was treated, in an experience of three successful cases treated by the laryngostomy method, found that in pure laryngeal stenosis, when he used a tube as advocated by Jackson, to get the best results in severe cases he needed to have the dilating tube at a level slightly higher than just above that of the cord. This led to difficulty in the matter of swallowing food afterwards, owing to the passage of food particles and liquids into the trachea. To overcome this he left the tracheotomy tube in and placed a glove finger over the upper end of the tube.

He also encountered difficulty in the removal and replacement of Jackson's dilating apparatus, and he devised an ingenious modification which was easier to pass in and out of the laryngostomy opening. Jackson stresses the necessity of obtaining an elongated fusiform laryngostomy opening rather than a circular one to overcome this difficulty.

In recent years Jackson has given up the laryngostomy method and now uses rubber core moulds. These are introduced through or alongside a direct laryngoscope with a special introducing forceps, gradually increasing sizes being used as the lumen enlarges.

The cicatricial tissue is absorbed because of the elastic dilatation of the rubber moulds. Jackson expresses the opinion that there is a "peculiar recession of tissues caused by contact with rubber". The moulds are so shaped (see Figure IV) that when they are in place there is a mass of rubber projecting backwards which prevents the tube from slipping downward, and just below the cords there is a bulge which prevents the tube from easily slipping upward. This shape, combined with a distal loop which is tied around the tracheotomy tube, does away with the need for retaining strings.

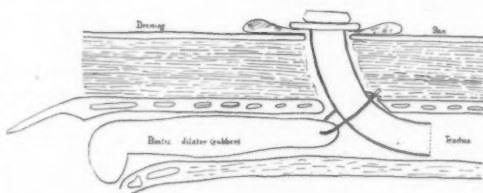


FIGURE IV. Drawing of sagittal section through the neck to show rubber core mould in position as used by Chevalier Jackson.

Sometimes in a difficult case a silk cord is used, which is threaded through the hole for the distal loop, and which is pulled on from below, to help the push of the introducer, when the mould is being inserted. Each mould becomes loose in about a fortnight and a larger one is put in its place, until one as large as the lumen of the cricoid cartilage will allow is reached. This is worn for six months, the moulds being replaced every three weeks. This is followed by a test period of six months with a corked cannula.

Then, if the patient is comfortable with the cannula completely corked, he is probably cured. If not, a further six months' treatment with the core moulds is carried out. The tracheal fistula should be left for a further six

months after the successful test period before closure, although it is covered over by gauze and strapping or "Elastoplast".

#### *Skin Grafting.*

The principle of the skin grafting method is to use skin to produce a ready-made epithelial covering for the area after removal of the cicatricial tissue in the ordinary way.

Negus<sup>(5)</sup> has found that Schmiegelow's method, with the use of a thin skin graft of the Thiersch type covering the dilating tube, has proved very satisfactory. The tube need be left in only for ten to fourteen days instead of six to ten weeks. He thinks that the laryngostomy method is tedious and painful, but if this method is used, a thin skin graft can be placed over the obturator or rubber tubing.

Negus has also in certain cases performed plastic operations, using skin flaps. He makes a gutter first and then converts it into a tube by dividing and turning in part of the skin flaps.

Various modifications can be devised for individual cases; sometimes a tubular pedicle graft can be used to advantage in a difficult problem. One method of dealing with the case with collapse due to loss of cartilaginous laryngeal framework is to remove the obstructing cicatricial tissue, to skin-graft the area, and then to continue the dilatation for some months by the wearing of an obturator either through a laryngostomy opening, if that has been used, or by an intubation tube type introduced from above.

#### CONCLUSION.

From his limited experience in this class of case, from a study of the literature, and from knowledge gained by discussing difficulties with others who have had experience, the writer feels that, for tracheal and laryngo-tracheal (that is, subglottic) stenoses which cannot be treated by dilatation and Jackson's decannulation by the corking method, Schmiegelow's method, combined with a thin skin graft, is probably the best and the least time-consuming both for the patient and the surgeon. For gross laryngeal stenoses without a severe degree of collapse due to loss of the cartilaginous framework, the laryngostomy method is probably the surer; but, on account of the extra time necessary and the greater amount of attention necessary with the open method, there is no reason why, if the surgeon thinks it has a reasonable chance of success, Schmiegelow's method with skin grafting should not be tried first. Or, if there is a lumen, though small, Jackson's rubber core mould treatment could be given a trial with very little inconvenience to the patient. This point will be decided after the careful preliminary summing up of the case.

It would seem that the method of skin grafting should be considered oftener than it has been in the past, and that in the future will be used in some form in every case.

#### PROGNOSIS.

Patients with chronic laryngeal stenosis wearing a cannula, or with a laryngostomy opening, must understand the nature of their condition, and they must never be immersed in water accidentally or while swimming. Jackson lost a patient who fell into water accidentally and drowned before help could reach him.

The whisper is never lost as long as air passes from the lungs up through the mouth. After treatment of the stenosis this whisper increases in strength until a rough voice is developed. As time passes, the voice improves as some sort of adventitious cord develops. If the mobility of the parts of the larynx is retained, new cords practically indistinguishable from the original cords develop from the pull of the vocal process of the arytenoids. Some patients get a good deeply pitched voice by phonating with the ventricular bands. As Jackson has said, the functions of the larynx—phonatory, protective, respiratory and tussive—are all restored in most cases.

#### SUMMARY.

1. The historical aspect of chronic laryngo-tracheal stenosis is briefly reviewed and the condition is defined.
2. The ætiology, pathology, symptoms and diagnosis are briefly dealt with.
3. The methods of treatment are fully discussed.

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## **Surgical Technique.**

### **A MODIFICATION OF THE UPPER ABDOMINAL PARAMEDIAN INCISION.<sup>1</sup>**

By VICTOR M. COPPLESON,  
*Sydney.*

A STRONG and intact rectus muscle is one of the most valuable factors in the prevention of post-operative hernia. In making the paramedian incision in the upper abdomen, some surgeons split the muscle longitudinally, whilst others retract it laterally. Splitting the muscle is a simple procedure and can be rapidly accomplished. For this

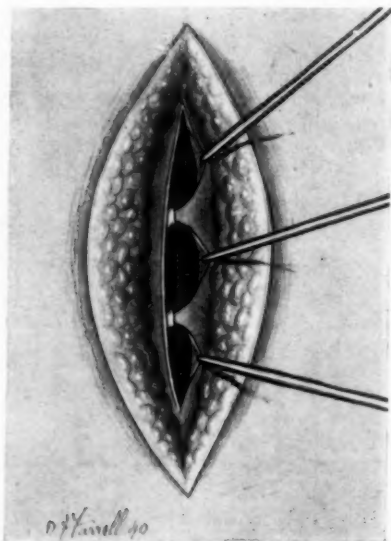


FIGURE I.

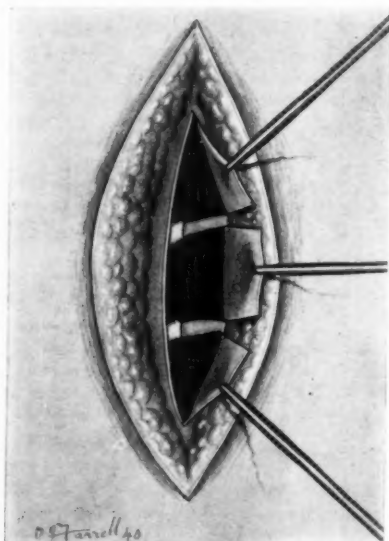


FIGURE II.

reason many surgeons prefer it. Lateral retraction would appear theoretically to give less interference with the normal anatomy of the muscle. Lateral retraction, however, may be somewhat tedious owing to the presence on the anterior surface of the muscle of three or more transverse tendinous intersections which are firmly adherent to the anterior wall of the sheath of the muscle. The lowest is at the level of the umbilicus, the highest near the xiphoid process. In order to retract the muscle laterally, one or two of these attachments must usually be dissected free. While this is being done, the

<sup>1</sup>Accepted for publication on October 17, 1940.



muscle may be damaged either by its being buttonholed, by the detachment of muscle fibres and their consequent retraction, or by thinning of the muscle at the site of the tendinous intersections. Should any of these accidents occur, it is probable that the remaining muscle is weaker than if it had been split.

To overcome these difficulties the following method of freeing the muscle has been devised. The incision is deepened to the anterior sheath of the rectus. This is cleared by drawing the handle of the scalpel along the sheath in the line of the incision. The anterior sheath is then incised longitudinally about half an inch lateral to the medial border of the rectus. When this is done, the cut portions of the anterior sheath retract except at the attachment of the tendinous interseptions. Artery forceps are then placed on the edge of the medial flap of the sheath, midway between the tendinous interseptions. The anterior sheath can then be easily separated from the muscle by blunt dissection and, when the dissection is completed, the muscle is left attached to the anterior sheath only at the tendinous interseptions (Figure I). A pair of scissors is then taken and the anterior sheath below and above the attachments is cut transversely (Figure II). These cuts are joined by a short longitudinal cut at their medial ends, so that the muscle can be retracted laterally. A small oblong portion of the anterior sheath is thus left attached to the tendinous interseptions (Figure III).

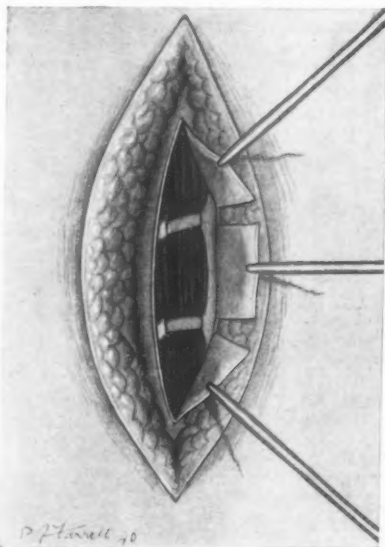


FIGURE III.

This procedure can be rapidly carried out and gives a firm, intact muscle which is considerably stronger than that which remains after dissection of the muscle from the anterior sheath or splitting it. The defects in the anterior sheath are easily corrected during the subsequent suture, and can be resutured without the slightest difficulty.

## Case Reports.

### BILATERAL ASTROCYTOMATA OF THE CEREBRAL HEMISPHERES.<sup>1</sup>

By GILBERT PHILLIPS AND W. LISTER REID.

(From the Department of Surgery, University of Sydney.)

IN a recent review of the literature, Courville<sup>11</sup> has collected 113 cases of multiple gliomata and added 21 personally studied cases. Of these 134 cases he states: "In the majority of cases the tumours proved to be multiform glioblastomas; multiple astrocytomas or other forms are much more rare. In the author's series, multiple astrocytomas were found only in the cerebellum (vermis and lobe) and thalamus."



FIGURE I. Photograph of the gross specimen removed at operation from the left parietal region.

The present case is reported because a single large astrocytoma was discovered in each cerebral hemisphere and these tumours were not connected histologically. One tumour was completely removed at operation two months before death, and the second tumour was not suspected until a few days before death.

<sup>1</sup> Accepted for publication on November 13, 1939.

The patient, a female aged forty-one years, was referred by Dr. Warren Harding on January 23, 1939. The following history was received from Dr. Harding:

"Approximately eighteen months ago she complained of a dull headache. Her physician advised the removal of her tonsils and a submucous resection of the nasal septum. It was suggested that one or more of the accessory nasal sinuses showed some infection. There was no relief from these operative procedures, which were carried out twelve months ago. On awakening, for the past eight months or more, she suffered from a headache and extreme nervous irritability, both of which symptoms seemed to wear off as the day passed. At intervals she noticed a moderate amount of vertigo, but with no tendency to fall in any one direction. Last November she had a 'stroke'

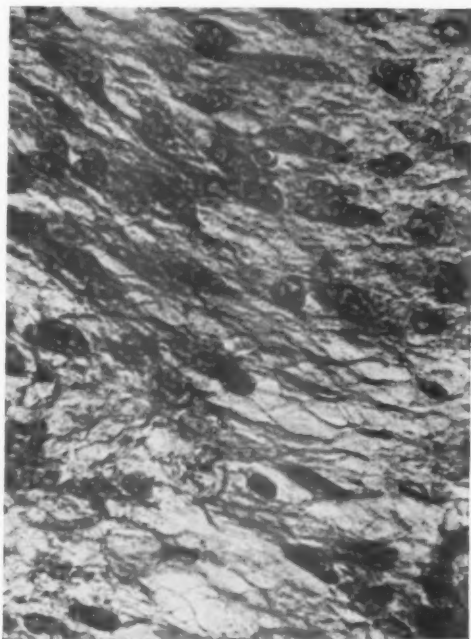


FIGURE II. Photomicrograph of a section taken from the neoplasm shown in Figure I. Practically all the cells in this photograph are fibrous astrocytes.

which confined her to her bed for one week. She was suddenly stricken unconscious, frothed at the mouth and both arms contracted violently. Three weeks later a similar attack occurred. The period of loss of consciousness was about forty minutes and a second attack followed twenty minutes later. In the first attack the right arm contracted and became rigid, but in the second one the arm did not appear to be affected. Both these attacks followed a rather severe emotional strain. She has not been well since the last attack due to headaches, poor memory and inability to use the right arm, which has had intermittent attacks of twitching. When the twitching appears, she is able to control it by conscious effort after thirty or forty seconds. The middle and ring fingers on the right hand feel numb. In the last few days she has become very depressed, irritable and has had some claustrophobia."

On January 23, 1939, examination by one of us (G.P.) disclosed that the visual acuity was  $\frac{5}{6}$  in the left and  $\frac{6}{12}$  in the right eye. The visual fields were full. The

pupils were rather irregular. The right pupil was slightly smaller than the left. Both pupils reacted well to direct and consensual light and on accommodation. The external ocular movements were full. There was no ptosis, proptosis, nystagmus or diplopia. The outlines of the optic disks were somewhat indefinite. There were no physiological cups present. The fundal veins were very full. The corneal reflexes were normal. There was no disturbance of facial sensation. There was a faint suggestion of left lower facial weakness both at rest and on emotional movements, but this was considered to be habitual. There was a considerable loss of power in the



FIGURE III. The posterior surface of a coronal section through the brain after fixation. This shows the anterior end of the neoplasm in the right hemisphere. The base of the operation site in the left parietal region is marked by an arrow. Note that the gliosis in this situation has filled up the defect and has caused traction on the body of the left lateral ventricle.

right hand grip, and there was some slight spasticity in the right elbow. The right triceps jerk was slightly exaggerated. The skin on the right hand was rather pale compared with the left and somewhat glossy and atrophic in appearance. She was left-handed, but there was no defect in speech. There was no tonic innervation of the right hand and no Hoffmann sign. There was no weakness in any of the other

extremities. The abdominal reflexes were all present. The right knee jerk was slightly exaggerated compared with the left. The ankle jerks were equal. There was no clonus and both plantar reflexes were flexor. There was no disturbance of deep or superficial sensation.

She was admitted to hospital the same day for further investigation. Plain X-ray photographs of the skull disclosed no radio-opacity and no signs of increased pressure. Lumbar puncture disclosed clear cerebro-spinal fluid under a pressure of 120 millimetres of cerebro-spinal fluid, with a protein content of 20 milligrammes *per centum*.



FIGURE IV. The posterior surface of a coronal section through the brain at the posterior extremity of the neoplasm in the right hemisphere. Note the cystic degeneration in the tumour and the involvement of the *corpus callosum* in this region which did not extend forwards to the level of the tumour in the left cerebral hemisphere.

On February 2, 1939, under "Avertin" anaesthesia a burr hole was made over the frontal lobe. The bone was extremely thick. The dura did not appear to be under increased pressure. A brain needle was passed into the anterior horn of the right lateral ventricle. Twenty-five cubic centimetres of air were injected after a similar amount

of cerebro-spinal fluid had been removed. The right lateral ventricle appeared normal, but no air passed to the left side. Twenty cubic centimetres of air were then injected by the lumbar route and further radiograms disclosed a filling defect in the body of the left lateral ventricle.

On February 2, 1939, under "Avertin" anaesthesia a large bone flap was reflected over the left Rolandic area, and a tumour was seen appearing on the surface immediately behind the upper portion of the left motor cortex. The tumour could be separated from the brain and it was at first thought from its appearance and situation that it was a parasagittal meningioma, but no attachment to the falx was found. The tumour was removed in one piece and measured 6.0 by 5.0 by 3.5 centimetres. Its histological characters are described later.

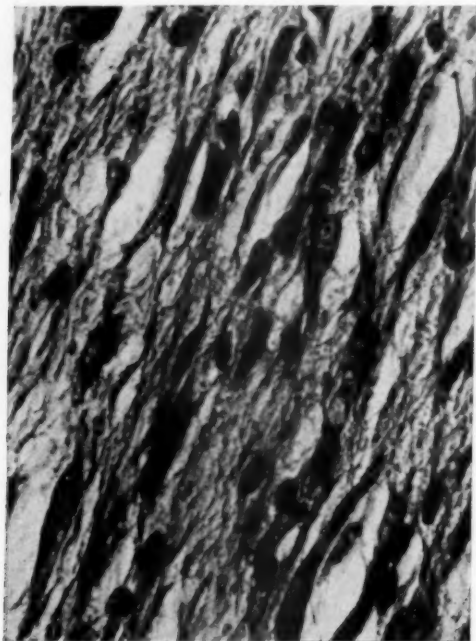


FIGURE V. Photomicrograph of a section of the neoplasm in the right parietal region. The cells are fibrous astrocytes. Note the tendency of the cells and fibres to lie in parallel rows.

The patient's post-operative condition was satisfactory; she regained consciousness twelve hours after operation, and at that time she was incontinent of urine, and had paresis of the right arm and leg, but not the right side of the face. The incontinence disappeared three days after operation, and during the next month with physical therapy she gradually regained power in the right arm and leg. She was then regarded as having completely recovered, and on March 27, 1939, the progress note read "feeling very well; is considering going to Queensland to see her daughter". However, her daughter was brought down to Sydney and she remained in hospital in order to continue her physical therapy.

On April 17, 1939, it was reported that she had had several transient headaches in the past few days and was occasionally mentally confused. On that date it was observed



that the right arm was becoming spastic and she had a number of twitching movements in the right leg. The right plantar response was extensor. The left lower facial weakness was thought to be more obvious than before. The most prominent change in her condition, however, was the very sudden development of mental hebetude accompanied by marked dysphasia. She became incontinent of urine again within twenty-four hours of the appearance of these signs and passed into coma on April 21, 1939.

At first it was believed that some of the original tumour must still be present and had extended across the *corpus callosum* to produce such rapid mental deterioration.

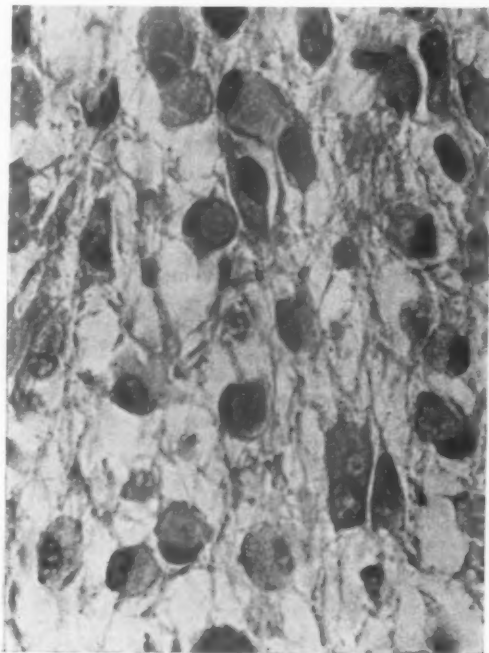


FIGURE VI. Photomicrograph of the section of the neoplasm in the right hemisphere. Practically all the cells are gemistocytic astrocytes.

However, on reflection, particularly in view of the fact that she was left-handed, it seemed more likely that the dysphasia and left lower facial weakness were not false localizing signs and that probably a deeply situated tumour was present in the right cerebral hemisphere. In any case, no further surgical intervention appeared to be indicated, and she died in coma on April 27, 1939.

The following account is a description of the brain pathology studies by one of us (W.L.R.).

The tumour from the left parietal lobe measured 6.0 by 5.0 by 3.5 centimetres (Figure I). It was firm and compact and had a nodular surface. On section it was mainly firm, but there were some areas of necrosis and hemorrhage into the substance of the tumour.

Microscopically the picture presented was that of a fibrous astrocytoma. The astrocytes were arranged without any definite pattern except that there was a slight tendency for the cells and fibres to lie in more or less parallel rows (Figure II). No

mitotic fibres were seen. The tumour tissue was moderately vascular and the connective tissue was mostly confined to the blood vessels.

Around the tumour the brain tissue was degenerated and lacked its normal architecture. In many places there was an attempt at the formation of a glial barrier between the tumour and the brain.

When the brain was removed at autopsy, a small irregular depression was seen in the left fronto-parietal region indicating the site of operation. There was no gross evidence of tumour tissue in this region. Sections were taken from the base of the operation site, and these revealed a small area of degenerated and inactive tumour cells.

After fixation in 10% formalin the brain was sectioned and a large second tumour was found situated deep in the right parietal lobe, measuring 6.0 by 5.0 centimetres on cross-section and about 6.0 centimetres antero-posteriorly (Figures III and IV). It had invaded the basal ganglia and walls of the lateral ventricle. The *corpus callosum* was invaded throughout the greater part of its length, and posteriorly the tumour had spread across the mid-line to the left side for 2.5 centimetres. The substance of the tumour was firm, with areas of necrosis and hemorrhage scattered throughout.

The tumour involved the right hippocampal gyrus, which was herniated downwards over the anterior end of the free edge of the *tentorium cerebelli*. The substance of the herniated hippocampus was occupied by a relatively elongated cyst, which is well demonstrated in Figure III.

On microscopic section the picture was similar to that of the first tumour. The great majority of the cells were fibrous astrocytes which were arranged, in most cases, in a loose glial meshwork. Here and there they were more compact, lying roughly in parallel rows. There were several areas in which the cells were the gemistocytic type of astrocyte (Figure VI). No mitotic figures were seen. The distribution of blood vessels and connective tissue was similar to that seen in the first tumour.

Deeper sections taken from the brain tissue lying between the operation site and the tumour in the right parietal lobe did not reveal the pressure of tumour cells, nor was there any gross evidence of a connecting link between the two tumours.

Courville's review of the literature shows that bilateral astrocytomata of the cerebral hemispheres are extremely rare. Of all cases of astrocytoma coming to autopsy, only one in sixteen is multiple and of these the great majority occur in the cerebellum or the thalamus.

Another interesting point revealed in this case was the fact that the right lateral ventricle appeared normal in the ventriculograms only twelve weeks before death, which was undoubtedly due to the right-sided tumour alone.

#### Reference.

- <sup>(1)</sup> C. B. Courville: "Multiple Primary Tumours: Review of Literature and Report of 21 Cases", *American Journal of Cancer*, Volume xxvi, 1936, page 703.

## A CASE OF DIAPHRAGMATIC HERNIA.<sup>1</sup>

By AUBREY MASON,

Superintendent of Ashburton Hospital, New Zealand.

THE patient, a young man nineteen years of age, was admitted to hospital under my care on September 10, 1936, with the tentative diagnosis of diaphragmatic hernia.

The history was that he had been subject to attacks of upper abdominal pain, colicky in nature, and associated with nausea and vomiting. The pain tended to radiate up into the left axilla, and the attacks were accompanied by some respiratory distress, but no cyanosis. The attacks had been increasing in frequency, each attack generally lasting a few days.

"Chest attacks", averaging about one per year, had started without warning in the early years of life (second or third), and had later developed into the attacks described.

On examination the patient was reasonably healthy in appearance. His chest presented some degree of deformity, with the sternum prominent and keel-like in its lower part, the lower ribs and costal cartilages being hollowed adjacent to the sternum. A diffuse cardiac thrill was palpable. On percussion of the chest there was revealed some dullness of the left lung base, especially in front. On auscultation, the heart sounds were regular and clear in all areas, but associated with peculiar sounds, particularly outside the apex. Borborygmi were audible over the lower part of the chest on both sides posteriorly. The air entry was somewhat impaired over the left base. The abdomen was retracted and there was wide divarication of the *rectus abdominis* muscles, extending down into a small umbilical hernia. A barium meal showed the stomach to be in a normal position, but when the opaque meal was followed down the bowel, the shadow of the barium appeared above the general diaphragmatic level when it had reached the colon. A barium enema showed half the transverse colon, the ascending colon and caecum, and some coils of ileum to be above the diaphragm, in relation with the cardiac shadow, and apparently lying in front of and on each side of the heart.

Operation was undertaken on October 7, 1936, with the aid of intratracheally administered ether anaesthesia. The condition was primarily approached via the abdomen, by an upper vertical incision between the separated recti muscles slightly to the left of the mid-line.

When the abdomen was opened a considerable length of large bowel and small bowel was found to be passing up through an opening placed anteriorly in the diaphragm. It was found possible to bring down much of this bowel into the abdomen, but a certain amount remained fixed by adhesions. It was now obvious that the opening in the diaphragm was centrally placed in front, being rather more extensive to the left of the mid-line and about two and a half inches in diameter. The xiphoid sternal portion of the diaphragm was absent and the falciform ligament of the liver was running into the thoracic cavity. The abdominal contents remaining held in the thoracic cavity by adhesions consisted of about nine inches of ileum, the caecum and appendix and the ascending colon, with a small accessory lobe of the liver.

The incision was extended up into the chest by continuing the abdominal incision somewhat obliquely upwards, dividing the left seventh and sixth costal cartilages, and continuing transversely outwards in the fifth left intercostal space to about the nipple line. Use was then made of a rib retractor. The heart was found to be comparatively unfixed, with the adherent bowel below it and slightly to the right. The adherent bowel was gradually freed. It was mainly fixed to the posterior wall of the cavity, but a portion was fixed to the anterior wall and the caecum to the inferior surface

<sup>1</sup> Accepted for publication on April 10, 1940.

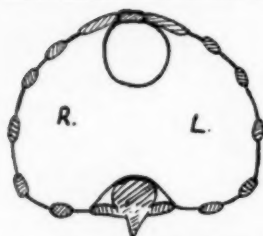


FIGURE I. Diagrammatic section at level of diaphragm to show site of hernial opening.



FIGURE II. First stage in closure of hernial opening.



FIGURE III. Final stage in closure of hernial opening.



FIGURE IV. Opaque enema showing hernial contents and disposition of bowel.

of the pericardium. The right side of the gap in the diaphragm was blocked by liver, with the small accessory lobe already mentioned on the left side running up into the hernial cavity. The peritoneal lining of the cavity, together with the falciform ligament, was gradually freed and pulled out of the cavity, and the diaphragmatic edges of the hernial ring were exposed. These edges were freshened and the opening in the diaphragm was closed by a series of number 4 chromicized gut sutures as shown in Figures I, II and III.

At the end of the operation the opening was completely closed, the suture line being under some tension, but not an unreasonable amount. Some of the anterior sutures were placed into the intercostal muscles and pleura, and some round the costal cartilages and into their perichondrium. The wound in the chest wall was closed, the divided costal cartilages being sutured together. The vermiform appendix was much thickened, with a constriction at the base and showing signs of chronic inflammation. It was removed. The caecum, ascending colon and part of the transverse colon were now quite mobile and swinging free on a primitive arrangement of their mesentery. They were replaced in the abdomen in their usual anatomical position without any attempt at fixation, and the abdominal part of the wound was closed.

At the end of about a week the patient had a rise in temperature and showed dulness over the lower part of the left lung and signs of fluid in the left side of the chest. Straw-coloured fluid was aspirated from the left side of the chest. The temperature continued to swing and an empyema developed. This was drained by resection under local anaesthesia of a portion of the eighth rib posteriorly. Eventually the chest cleared and the wound healed.

An X-ray examination made before the patient's discharge from hospital revealed a fairly normal diaphragmatic outline with the caecum, ascending colon and transverse colon occupying an apparently normal anatomical position. Further skiagrams taken on May 14, 1939, showed a good diaphragmatic outline and again showed the large bowel to be in normal position.

During the interval the patient has enjoyed good health and has been quite symptom free, and has been engaged in mustering in high sheep country.

#### Comment.

This case illustrates several points concerning diaphragmatic hernia.

Herniae at the parasternal area usually produce relatively severe symptoms due to partial obstruction of the colon and to crowding of the heart and lungs.

Although the hernia apparently possessed a sac, from the duration of the history and the nature of the contents it would appear to have been of a congenital type.

At operation the necessity for supplementing a purely abdominal approach by a thoracic exposure to deal with the adhesions of contents in the chest was fully demonstrated.

Pleural effusion and empyema are a possible complication, particularly when the approach has been via the thorax.

## UNILOCULAR CYST OF THE SPLEEN.<sup>1</sup>

By AUBREY MASON,

*Superintendent of Ashburton Hospital, New Zealand.*

THE patient, a female seventeen years of age, was admitted to hospital on March 27, 1939. The history was that for the last six years she had been aware of a lump in the left side of the upper part of the abdomen. It had appeared suddenly and painlessly, she thought. It had increased somewhat in size in the few months prior to her admission to hospital. There was no pain, no loss of weight, no lassitude, appetite was good and there was no dyspepsia. The patient had lived all her life in a "hydatid area" and had had frequent contact with sheep dogs. There was no history of injury.

On examination, the patient was found to be a fairly well-nourished girl in no apparent distress. A rounded swelling extending down towards the umbilical level occupied the left upper quadrant of the abdomen and produced definite bulging of the left costal margin. The tumour felt smooth and cystic, and on its outer side below the costal margin an edge could be felt suggestive of the margin of the spleen. It moved only slightly and was dull to percussion. The urine was normal, and pyelography revealed no abnormality. The Casoni and hydatid complement fixation tests produced no reaction. The response to the Wassermann test was negative. The hæmoglobin value was 100%, the erythrocytes numbered 4,900,000 per cubic millimetre, and the leucocytes 7,500. The differential white cell count revealed no abnormality.

Operation was performed on April 12, 1939, under ether anaesthesia. A left para-rectal incision was employed extending from the costal margin to about one and a half inches below the umbilicus. The tumour was found to be a large cyst arising from the upper and inner aspect of the spleen, the anterior margin of which was still preserved. The cyst, which was greyish in colour with plaques of scattered calcification in its walls, occupied practically the whole of the left upper quadrant of the abdomen, displacing both the colon and stomach. There were fairly firm adhesions to the diaphragm and the left margin of the liver; otherwise the tumour was free. The cyst was aspirated with an Ochsner trocar and cannula, and about three pints of thin opalescent chocolate-coloured fluid were removed, and the opening in the cyst was closed. The adhesions were separated without much difficulty, all being clamped, cut and ligated. The spleen was then readily delivered and removed. Recovery was uneventful.

The pathological report by Dr. A. B. Pearson (Christchurch Hospital, New Zealand) was as follows:

*"Naked Eye.* The spleen was much enlarged and almost entirely occupied by a large single cyst. On the outer surface of the spleen there are rough adhesions and a general thickening of the capsule with irregular thin plaques of calcification. The cyst is filled with thin chocolate-coloured fluid heavily loaded with cholesterol crystals. The inner surface of the cyst is lined by old blood clot and shows also plaques of calcification not covered by blood. Here and there the wall is extremely thick and consists of dense tough fibrous tissue. The cyst shows no definite wall—it is more like a fluid-filled cavity in the spleen.

*"Microscopic.* Sections of the cyst wall show a dense layer of hyaline fibrous tissue separating the cavity from the splenic tissue. This fibrous tissue encloses areas of old hæmorrhage, collections of cholesterol crystals and plaques of calcification. On its inner aspect is a thin layer of cells resembling splenic tissue, but showing areas of hæmorrhage and numerous vascular spaces. The innermost lining appears to consist of a layer of cuboidal cells with abundant cytoplasm and vesicular nuclei. These cells sometimes occur in a single layer (and are often flattened) and occasionally, in

<sup>1</sup> Accepted for publication on April 10, 1940.




angles in the cyst wall, are found in a number of layers, the arrangement rather resembling transitional epithelium. The surrounding splenic tissue shows prominent venous sinuses lined by a cubical epithelium. There is a considerable increase in fine fibrous tissue throughout the pulp and especially round the vessels and in the septæ. Malpighian follicles are rather scanty. The capsule shows a fibrous thickening. The appearances are those of a simple unilocular long-standing and degenerate cyst of the spleen—the remnants of lining suggest the possibility of a hæmangioma."

#### Comment.

The case is of interest on account of the obscurity of origin of the condition. The more usual origin would appear to be intraparenchymal or subcapsular hæmorrhage. The pathological report suggests another possible cause in this case.

#### Bibliography.

Benjamin Sherwin, Chester R. Brown, Amour F. Liber: "Cystic Disease of the Spleen", *Annals of Surgery*, Volume cix, April, 1939, page 615.



## MULTIPLE FIBROMATA OF THE TUNICA VAGINALIS.<sup>1</sup>

By L. H. BALL,  
*Melbourne.*

MULTIPLE fibroma of the *tunica vaginalis* is one of those exceedingly rare conditions which may be clinically indistinguishable from a teratoma of testis and which is diagnosed only after removal of the organ.

The patient about whom this is written had a tumour of his left testicle which was diagnosed by his doctor and by myself, then by a senior consultant, as a malignant tumour of his testicle.

### Clinical History.

A.L.R., aged forty-four years, consulted his doctor about a pain in his right hip. Nothing abnormal was detected, but in the course of examination it was noticed that he had a tumour, the size of a small orange, of his left testicle. This was painless and

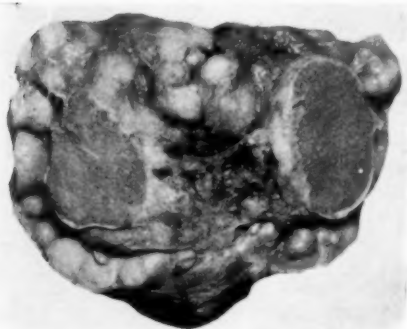


FIGURE I. Whole specimen (two-thirds natural size).



FIGURE II. Whole specimen (two-thirds natural size).

symptomless—in fact, the patient was quite unaware of its presence—so that no estimate could be made as to the length of time it had been growing.

The tumour was firm, irregular, nodular and not tender. Testicular sensation was diminished and no abdominal glands could be palpated. There was no venereal history and the response to the Wassermann test was negative. X-ray examination of his lungs and pelvis did not reveal evidence of secondary growth. The left testicle was removed and the patient had an uneventful convalescence.

The macroscopic appearance of the specimen is shown in Figures I and II and the microscopic in Figure III.

### Pathological Findings.

Dr. R. A. Willis, pathologist to the Alfred Hospital, made the following report: "*Macroscopic Description.*—The testis appears entirely normal. The parietal layer of the *tunica vaginalis* is thickly studded by multiple rounded projecting masses, varying in size from that of a pin's head up to two centimetres in diameter, and numbering

<sup>1</sup> Accepted for publication on July 11, 1939.

more than one hundred. These nodules are smooth-surfaced, hard, and on section consist of a white fasciculated fibrous tissue. The smaller nodules are sessile, but many of the larger ones are slightly pedunculated. The visceral layer clothing the testis is almost free of the growths, presenting only a few small nodules near its reflection onto the parietal layer. The spermatic cord, of which about four centimetres are attached to the specimen, contains no growths. There is no evidence of any infiltration beyond the tunica itself. The total weight of the specimen, including the testis, but not including the small quantity of fluid which was present in the cavity, is 120 grammes.

**"Microscopic Description.—**The structure of the tumours is uniform throughout, presenting a densely fibrous, lowly-cellular tissue, consisting largely of interlacing bundles of collagen fibres with much hyaline change. Blood vessels are extremely few and small. Scattered through the fibrous tissue there are many groups of typical plasma cells, and a few lymphocytes. The tumour is a densely fibrous fibroma, histologically quite benign."

#### Discussion.

From the literature it would appear that fibroma of the *tunica vaginalis* may be either single or multiple, and that usually there is in association a very thickened tunica, although in the case under review this was not so.

G. Gordon-Taylor,<sup>(1)</sup> in a most exhaustive review of the literature up to 1934, was able to collect fourteen cases of this condition, and I can find a report of only one other by Thompson<sup>(2)</sup> in 1936. The condition does not appear to be mentioned in any of the standard textbooks of surgery or pathology.

Thompson, in commenting on the rarity of tumours of the *tunica vaginalis*, states that in the literature there are recorded three cases of lipomata, two of adenomata and three of myomata.



FIGURE III. Photomicrograph ( $\times 55$ ).

#### References.

- <sup>(1)</sup> G. Gordon-Taylor: "Multiple Fibromata of Tunica Vaginalis", *British Journal of Urology*, 1934, Volume vi, page 320.
- <sup>(2)</sup> G. J. Thompson: "Tumors of Spermatic Cord, Epididymis, and Testicular Tunica", *Surgery, Gynecology and Obstetrics*, 1936, Volume lxii, page 712.

## Surgery in Other Countries.

[In this column will be published short résumés of articles likely to be of practical value from Journals published in other countries and not readily accessible to surgeons in Australia and New Zealand.]

### RECONSTRUCTION OF THE UPPER AND MIDDLE PARTS OF THE NOSE BY AN ORIGINAL PROCEDURE.

F. Stefani (Naples): *Rivista di Chirurgia*, September, 1937, pages 433 to 439.

THE patient was a young man who had a "saddle-back" nose, the result of lack of development of the nasal pyramid. The nostrils and the lower part of the septum were well formed. The serological tests produced no reactions. The restoration of the nose was carried out by a procedure described in the following way.

At the first operation a U-shaped flap, which has a frontal base and which encroaches to a great extent into the scalp, is cut. This flap is epilated and sutured back into place. This epilated skin forms the future endonasal covering of the graft.

At the second operation (a month later) (a) an inverted V-shaped incision encroaching on the forehead is made and the skin of the nose is dissected downwards. (b) The frontal flap, dissected up in the first operation, is cut; but this time it includes the skin, the periosteum and a rod-shaped piece of the frontal bone cut out with a saw held very obliquely—a piece of the outer cortex and of the diploe of the upper part of the frontal bone. (c) The flap is turned down, with the raw surface—the osseous surface—outwards. (d) The nasal flap is now put back in place, and covers the frontal flap, after the modelling and the fixation of the latter to the cartilages of the alæ of the nose. (e) The edges of the wound resulting from the cutting of the frontal flap are brought together and, where possible, sutured.

At a third operation (sixteen days later) division and trimming of the pedicle of the frontal flap are carried out in order to make a good scar.

The photographs attached to this article show the good result obtained.

J. ASSALI.

Analysis from *Journal de chirurgie*, Volume lii, August, 1938.

### THE TREATMENT OF THORACO-PULMONARY WOUNDS AND OF THEIR COMPLICATIONS.

Morelli (Rome): *La presse médicale*, March 6, 1938, pages 465 to 468.

IN wounds of the lung, the negative endopleural pressure has an effect on the injury like that of a cupping glass; that is, it sucks the blood into the pleural cavity. If to this there is added the respiratory movement of the lung, it will be obvious that the formation of a clot is impossible and that the hemothorax will progressively increase until the endopleural pressure disappears.

The hemothorax cannot really compress the lung unless it attains a sufficient volume to displace the mediastinum and the diaphragm; that is, only large quantities of blood—more than two litres—can really compress the lung; smaller quantities cause it to contract, but do not absolutely eliminate negative pressure. It seems, therefore, to Morelli that, instead of awaiting the elimination of the negative pressure by the large outpouring of blood, it is more logical to obliterate it at once by instituting a pneumothorax. That is, the essential treatment of thoraco-pulmonary wounds must be based on the institution of the pneumothorax.

A simple wound of the lung caused by small projectiles may be cured after a few days' treatment with pneumothorax. In the early stages of a pulmonary injury, if an apparatus for producing pneumothorax is not available, it is sufficient to separate the edges of the wound with a pair of forceps and to ask the patient to breathe deeply.

so that he may form a pneumothorax large enough to prevent the production of a hemothorax. If a pneumothorax is made in the first few hours, it is wiser not to make a positive pressure, but to keep it at atmospheric or a weak negative pressure. In the open pneumothorax the retraction of the lung, free from adhesions, is usually complete and a hemothorax is rarely seen; the atmospheric pressure is enough to prevent its occurrence. When the pneumothorax is open and when the bleeding occurs from a big vessel or when, because of adhesions, the atmospheric pressure is not sufficient to cause contraction of the lung, the parietal wound must be hermetically closed, in order to permit the institution of a closed pneumothorax with positive pressure. The suture of the parietal wound, however, is not sufficient; for the positive pressure of the pneumothorax would bring about a subcutaneous emphysema. To overcome this disability, Morelli employs little balloons of very elastic rubber, which are inflated after they have been introduced into the parietal wound. With these, he finds that he can completely close the parietal wound and at the same time minimize the patient's dyspnoea.

The gravest complications from pulmonary wounds are hemothorax and the pleural effusion which constantly accompanies it. Blood should not be left in the pleural cavity because it is thought that its evacuation facilitates the recurrence of the bleeding; the presence of blood in the pleura is harmful and gives rise to an empyema or to a reactionary pleurisy. The blood must be removed without causing the dehiscence of the pulmonary wound, the reopening of which would cause infection of the pleural effusion. If gas is substituted for the blood, this danger is avoided. Morelli describes an apparatus which he employs for thoracentesis for this purpose. He is convinced that it is a mistake to allow a hemothorax to be spontaneously reabsorbed; and also that it is dangerous to withdraw the blood without the substitution of gas. While in a thoracentesis the removal of fluid can only be partially effected without the substitution of air, that is to say, only up to the dilatation of the lung, the emptying of the pleura can be complete if pneumothorax is simultaneously effected.

Morelli notes that extravasated blood in the pleura can be very easily infected, and that even the remains of clots can give rise to pleural reactions. He thinks, therefore, that the pleural cavity should be washed out after the blood has been removed. Many surgeons deprecate washing out the pleural cavity because it causes reactions. If, however, the washing is done in the presence of a pneumothorax, that is, in the presence of positive pressure, no harm is caused. Thanks to a very simple apparatus of his own invention, Morelli achieves the washing of the pleura without danger.

Sometimes, in spite of washing, an empyema may follow a pulmonary wound, especially in wide gaping thoracic wounds. In this case, Morelli completely and constantly evacuates the pus, and so treats the patient that the lung occupies the pleural cavity as under normal conditions. By means of an apparatus, which he describes and figures, Morelli succeeds in carrying these fundamental ideas into practice. He also uses this apparatus in the treatment of common empyemata; and it is rare, he states, that a rapid cure is not obtained and a good dilatation of the lung in three weeks.

ANTOINE BASSET.

Analysis from *Journal de chirurgie*, Volume lii, August, 1938.

#### OBSERVATIONS AND REFLECTIONS ON ECHINOCOCCOSIS.

E. Kondoleon (Athens): *Bulletin de la Société médicale d'Athens*, May 29, 1937, pages 434 to 442.

The author summarizes the results of his observations on cases of hydatid cysts for the last three years as follows. He regards the hydatid thrill as a phenomenon produced by a condition which depends on concentration and tension of the hydatid fluid, and on the density and elasticity of the fibrous capsule of the cyst and the surrounding tissues. This sign may be observed in the hydatid cysts of the liver and abdomen; it is exceptional in cysts of the lung. The author has observed hydatid thrill in univesicular cysts. The existence of daughter cysts is, therefore, not indispensable to the production of this phenomenon.

Among 103 cases of hydatid cyst in various positions, verified by operation, the Casoni test gave no reaction in 15% of cases. Kondoleon thinks that the procedure would be more dependable if hydatid fluid from a cyst in the same anatomical situation was used for the test.

Radiological study of 16 cases of hydatid cyst of the lung reveals: in the large cysts, a regular, sharp-contoured cyclic image as if traced by a compass; in the multiple cysts, a blurred, irregular, badly defined image; in cysts of the base of the lung in the region of hepatic convexity, much difficulty in recognizing hydatid in this neighbourhood.

Reciprocal reactions of the parasite and the parenchyma of the host produce various morphological types, which range from multiple cysts with a scarcely visible fibrous capsule to old thick-walled cysts.

In the course of an operation Kondoleon observed a curious morphological form in a woman, aged forty-four years, who had been operated on five times for multiple hepatic and pulmonary cysts—swelling of the right lobe of the liver typical of hydatid. Puncture into the very middle of the swelling yielded a crystal-clear fluid. Incision of the parenchyma of the liver with an electric bistoury, following the trocar which was left in place, did not lead into any cavity; nevertheless, the hydatid liquid commenced to gush from the lobe of the liver. Careful examination failed to discover any cavity. The wound in the liver was tamponed and the patient rapidly recovered.

Kondoleon found a multiplicity of cysts in 17 cases out of 103 observations.

In regard to operative methods, as a result of his experience, Kondoleon condemns cystectomy—a procedure recently advocated by some Russian surgeons, particularly by Melnikoff. Primary suture of the cyst he regards as limited in its indications. He thinks the most prudent procedure is marsupialization—an operation which, though not brilliant, is sure. The long post-operative treatment necessary for the filling up of the wound can be shortened by careful partial resection of the fibrous capsule with exteriorization of the bottom of the cystic cavity.

X. J. CONTIADES.

Analysis from *Journal de chirurgie*, Volume III, July, 1938.

#### A NEW METHOD OF SACRAL ANÆSTHESIA.

Walter de Pay (Griefswald): *Münchener medizinische Wochenschrift*, Volume LXXXV, Number 2, January 14, 1938, pages 57 to 59.

THE author employs a 1.0% to 1.5% solution of "Novocain" in physiological salt solution with 0.005% of adrenaline to 100 cubic centimetres of solution, made viscous by addition of a 0.5% solution of gum arabic.

The patient is placed in the lateral position. The sacral cornua are identified and the sacral membrane is punctured. The arachnoidal cul-de-sac is situated six centimetres above this point. There should be no escape of blood or cerebro-spinal fluid. Sixty to seventy cubic centimetres of solution are slowly injected. Fifty patients have been operated on by this method without other incident than, in the case of women, some headaches and lumbar pains.

The author recommends this method for operations on the perineum, particularly in cases of infection.

MARCEL THALHEIMER.

Analysis from *Journal de chirurgie*, Volume III, July, 1938.

### Reviews.

**Field Ambulance Organization and Administration.** By LIEUTENANT-COLONEL J. HARDIE NEIL, N.Z.M.C.; amended and revised edition; 1940. London: H. K. Lewis and Company, Limited. Australia: Angus and Robertson, and W. Ramsay. Crown 8vo, pp. 128, with diagrams. Price: 5s. net.

THIS handy volume contains within its 128 pages a great deal of useful information for the field ambulance officer. Originally published in 1919, it has been hastily and somewhat crudely revised to meet an obvious need in these days of mobilization. Numerous medical officers more or less unversed in matters military are being called to the colours and should be glad of this "guide, philosopher and friend". Indeed, the old soldier may well read the volume with pleasure and profit. It bears the imprint of an authorship that is the outcome of practical experience, more particularly during the last war in western Europe.



The seven chapters successively deal with training, function and interior economy, quartermaster's department, duties of the personnel, establishment and organization of a divisional rest station, an advanced dressing station, the field ambulance during active operations. The nine appendices present a table of war establishments, lists of contents of the several medical and surgical panniers *et cetera*, instructions for testing water for chemical poisons and for estimating the amount of sterilizing powder required to render potable one hundred gallons of water.

Manifestly, it is impossible to bring such a book completely up to date on account of the rapid changes in martial technique and the widespread geographical distribution of a world war. The discriminating reader will readily discern the general principles and will not hesitate to modify details in the light of experience and his own appreciation of local conditions.

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**The British Orthoptic Journal:** Volume I, Number 1; 1939. London: The British Orthoptic Society. Price 5s. 6d. net.

THE members of the British Orthoptic Society are to be congratulated for their initiative in publishing the first journal devoted solely to orthoptics. The articles are, in the main, contributed by orthoptic technicians; that is, by lay persons trained to manipulate the elaborate and expensive gadgets which have been designed in recent years for the correction of strabismus and the restoration of binocular stereoscopic vision.

Miss Ida Mann gives her blessing with an interesting article on the evolution of the eye, and Wing-Commander Livingston contributes a balanced series of lectures on heterophoria. For the rest, we must agree with F. W. Law<sup>1</sup> that the "uncritical acceptance and the kindly, if somewhat lazy, acquiescence of the majority of ophthalmic surgeons" would be at least "unfortunate".

The technical articles reveal the lack of "knowledge and the sense of proportion with the consequent breadth of outlook which is necessary in dealing with a branch of medicine" of which Law speaks. The best example is the article by Miss Sheila Mayou on "A Few Examples of Traumatic Heterophoria". At the meeting at which the paper was read, Miss Mayou was gently but firmly reproved by the chairman (anonymous, but apparently an ophthalmic surgeon) for treating obvious cases of paralysis of the extraocular muscles. Mrs. Yoxall, in defence of Miss Mayou, pointed out that the cases had been referred by surgeons for orthoptic treatment. In the face of this astonishing statement, it would seem that the "acquiescence" of some ophthalmic surgeons at least is more than lazy.

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**Surgery of the Hand: Wounds, Infections and Closed Traumata. A Book for the Practitioner and the Surgeon.** By M. ISELIN, M.D.; translated by T. M. J. D'OFFAY, M.B., Ch.B., F.R.C.S. and T. B. MOUAT, Ch.M., F.R.C.S.; 1940. London: J. and A. Churchill Limited. Demy 8vo, pp. 366, with illustrations. Price: 21s. net.

THIS book is an English translation from the third French edition, which is now published in two volumes instead of one as formerly. The present book, Volume I, designated "The Practitioner's Book", consists of four parts, and deals with wounds, infections of the hand, closed traumata of the hands and fingers and assessment of incapacity. Volume II, "The Surgeon's Book", shortly to be published, will deal with the reparative surgery of the hand.

The writer's style is precise and to the point, demanding careful study. Some of the terms used are unusual, but, being descriptive, they can be readily interpreted. A wealth of information is contained in this small book, which is a welcome contribution to the literature in view of the importance of the subject; it will do much to clarify the reader's ideas and will repay careful study.

Wounds and infections of the hand bulk largely in workers' compensation practice and are often badly treated. The wrong conception of the underlying pathology and incorrect treatment thereof may result in serious disability. In the treatment of wounds of the hand as a result of experience with many workers' compensation cases, the author is inclined to dogmatize by such statement as "all compound fractures of the terminal phalanx involving the joint should be amputated"; but it is pleasing to

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<sup>1</sup> *Transactions of the Ophthalmological Society of the United Kingdom*, Volume lxx, Part II, 1939, page 523.

note that he draws a distinction between the labourer requiring radical treatment and a quick return to work, and those whose occupations require delicate manipulative dexterity. For the latter the extent of recovery is more important than the time factor, and for them a more conservative line of treatment is indicated.

The author's views on the treatment of sprains, following the work of Leriche, make surprising reading, and will need the test of time to substantiate them.

The section dealing with infection of the hand is concise and particularly good. The author's conclusions are based upon research and the clinical study of a large number of cases. In the anatomy of the cellular spaces of the hand he differs somewhat from Kanavel, to whom, however, due recognition is given. In the treatment of infections we think that undue prominence is given to so-called medical treatment with bacteriophage *et cetera*. In the operative treatment reference is made to the incisions of other authorities as well as those recommended by the author.

His treatment of fractures adds very little to the contributions of Böhler, whose work is acknowledged.

Part four deals with assessment of incapacity. A useful table is appended indicating percentage disability for various injuries.

The fact that the book has reached its third edition in the space of ten years shows that it fulfils a useful purpose. We await with interest Volume II, "The Surgeon's Book", on the reparative surgery of the hand.

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**The Hospital Care of Neurosurgical Patients.** By W. B. HAMBY, M.D., F.C.S.A.; 1939. Baltimore: C. C. Thomas. London: Baillière, Tindall and Cox. Demy 8vo, pp. 129, with illustrations. Price: \$2.00 net.

THIS book has been written for the guidance of house surgeons and nurses attending neurosurgical patients. It satisfactorily fulfils this object.

Its merit lies not in the introduction of any new ideas, but in the clear exposition of the minimum details which are necessary for the proper conduct of neurosurgical ward practice. Much stress is very rightly laid upon this, because it is based on the accumulated experience of the preceding years of this century. The author's directions are clear and concise, but he does not shirk the responsibility of explaining the variations of treatment which different schools of medicine follow; for example, the advisability of spinal puncture upon patients with head injuries.

The main portion of the book is concerned with explaining the principles of examination of the patients, and of their pre-operative and post-operative care in relation to brain injury, intracranial neoplasm and abscess and spinal compression. These are admirably discussed, as well as those minor surgical procedures which serve as diagnostic aids in disease of the central nervous system, for example, lumbar puncture, cisternal puncture, encephalography and ventriculography.

This is a book we confidently recommend to those engaged in neurological surgery, especially beginners.

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**Surgery of the Hand.** By R. M. HANDFIELD-JONES, M.C., M.S., F.R.C.S.; 1940. Edinburgh: E. and S. Livingstone. Imperial 8vo, pp. 149, with 95 illustrations, some of which are in colour. Price: 15s. net.

THIS is an excellent monograph which covers most of the surgical conditions that affect the hand.

The first and largest section of the book is concerned with infections, and in it the importance of prophylaxis is abundantly stressed. The author acknowledges the work of Kanavel in this field, and advocates his incisions and methods in all conditions except palmar space infections, in which he recommends his own transverse incision along the line of the distal skin crease.

The section on fractures follows the excellent principles laid down by Watson-Jones, from whose book many of the illustrations are reproduced. It is amazing how little exact information is available in most textbooks regarding the treatment of fractures of the hand, but here we have detailed methods which should guide even the novice. Injuries and infections of the hand form the largest proportion of cases covered by workers' compensation acts, and it behoves all practitioners who undertake this type of work to be well informed on the latest methods of treatment.

We should like to see a section on the technique of tendon suture, including the end-results obtained in the difficult cases in which the tendon is divided over the proximal interphalangeal joint.

The volume is completed by a short section on deformities and tumours of the hand.

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**Atlas of Cardio-Roentgenology.** By H. ROESLER, M.D., F.A.C.P.; 1940. Baltimore: C. C. Thomas. London: Baillière, Tindall & Cox. Crown folio, pp. 138. Price: \$8.50 post paid.

THIS atlas is a well produced American publication, which aims at demonstrating the radiological appearances of the commoner cardiac abnormalities, and correlating these appearances with those of the pathological specimens. Sixty case reports are given with the salient clinical features, results of special tests and electrocardiographic tracings. Twenty-eight of these case reports are accompanied by post-mortem findings. The pathological specimens are sectioned in a longitudinal plane, corresponding to either the anterior, right anterior oblique or left anterior oblique position. Photographs of these sections, taken both from the anterior and posterior position, are displayed opposite the appropriate skiagram. The main anatomical features are numbered, and a key is provided in the text.

This method of description demands concentration on the reading of the atlas, which contains a great amount of detail in its 124 pages, but cannot replace the personal investigation of post-mortem specimens, which is necessary to anyone who wishes to correlate cardiac pathology and symptomatology with the radiological picture.

The atlas should be a help to students interested in the radiology and pathology of the heart or to post-graduates studying for the diploma of radiology.

Cardiologists will find little that they do not already know, and as the volume does not attempt to cover the whole ground of cardiac Röntgenology, it cannot be substituted for one of the well-known textbooks on the subject. Despite these limitations, the atlas is an interesting publication which will help to facilitate the interpretation of skiagrams on a pathological basis.

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**Pye's Surgical Handicraft: A Manual of Surgical Manipulation, Minor Surgery and Other Matters Connected with the Work of House Surgeons and of Surgical Dressers.** Edited by H. BAILEY, F.R.C.S.; Twelfth Edition, fully revised; 1940. Bristol: John Wright and Sons Limited. Demy 8vo, pp. 595, with illustrations. Price: 21s. net.

THIS new edition of "Pye" has been thoroughly revised and also enlarged by twelve new sections, amongst which are noted "The Management of Thoracic Cases", "War Wounds", "Drugs and Sera", "Lumbar Puncture", "Ordering of Appliances", "Assessment of Incapacity" and "Hospital Administration". All these sections maintain the high standard of the last edition and make it definitely essential for all students and house surgeons. We would disagree with the statement that "it is dangerous to detail any description of spinal anaesthesia in a work of this character". If eighteen pages can be spared to describe inhalation anaesthesia, surely two or three pages might be added with a description of some standard technique for spinal anaesthesia, a knowledge of which is just as essential as is a knowledge of the administration of ether.

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## Proceedings of the Royal Australasian College of Surgeons.

### GORDON CRAIG LIBRARY.

FELLOWS of the College are advised that since the date on which the catalogue for the Gordon Craig Library was last issued, namely, June 30, 1940, the following new books have been added to the library and are available on loan: "Modern Treatment Year Book" (edited by Mr. C. P. G. Wakeley), 1940; "Surgery of the Alimentary Tract", Sir Hugh Devine, 1940; "Clinical Obstetrics", A. L. Mudaliar, 1938; "Theories of Sensation", A. F. Rawdon-Smith, 1938; "Surgery of Injury and Plastic Repair", S. Fomon, 1939; "War Wounds and Air Raid Casualties", *The British Medical Journal* articles, 1939; "Fractures and Other Bone and Joint Injuries", R. Watson Jones, 1940; "Displacement Method of Sinus Diagnosis and Treatment", A. W. Proetz, first edition 1931, second 1936; "Practical Nursing, Including Hygiene and Dietetics", W. T. Gordon Pugh, 1937; "Pye's Surgical Handicraft", edited by Hamilton Bailey, eleventh edition, 1939; "Rectal Surgery", W. Ernest Miles, first edition, 1939; "Surgery of Pain", René Leriche (translated and edited by Archibald Young), 1939; "Action of the Muscles", Sir Colin MacKenzie, second edition, 1940; "Hospital Care of Neurosurgical Patients", Wallace B. Hamby, 1940; "Surgery of the Hand", R. M. Handfield-Jones, 1940; "Nelson's Loose-Leaf Medicine of the Ear", E. P. Fowler, 1939; "The Injured Back and its Treatment", John D. Ellis, 1940; "Atlas Illustrating the Division of Cancer of the Uterine Cervix into Four Stages", League of Nations Health Organization, 1938; "Principles and Practice of Rectal Surgery", Wm. B. Gabriel, second edition, 1937.

### Notices.

#### NEW DEVELOPMENTS IN SURGICAL EQUIPMENT.

THE attention of Fellows is drawn to page xxvi among the advertisements, which illustrates some recent developments in surgical equipment. The Editorial Committee is responsible for the selection of the equipment thereon. The publishers will be pleased, whenever possible, to supply the names and addresses of the manufacturers to anyone requiring such information.

### Editorial Notices.

EDITORIAL communications should be addressed to the Chairman of the Editorial Committee, 57 Collins Street, Melbourne, or to any member of the Editorial Committee. It is understood that original articles forwarded for publication are offered to THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY solely, unless the contrary be stated.

Reprints can be supplied at cost price; the minimum number is fifty copies. Orders for reprints must be given when the proof is returned.

Exchange journals should be addressed to the Honorary Librarian, Royal Australasian College of Surgeons, Spring Street, Melbourne, C.I, Victoria, Australia.

Business communications and remittances should be addressed to Butterworth and Co. (Australia) Ltd., 6-8 O'Connell Street, Sydney.

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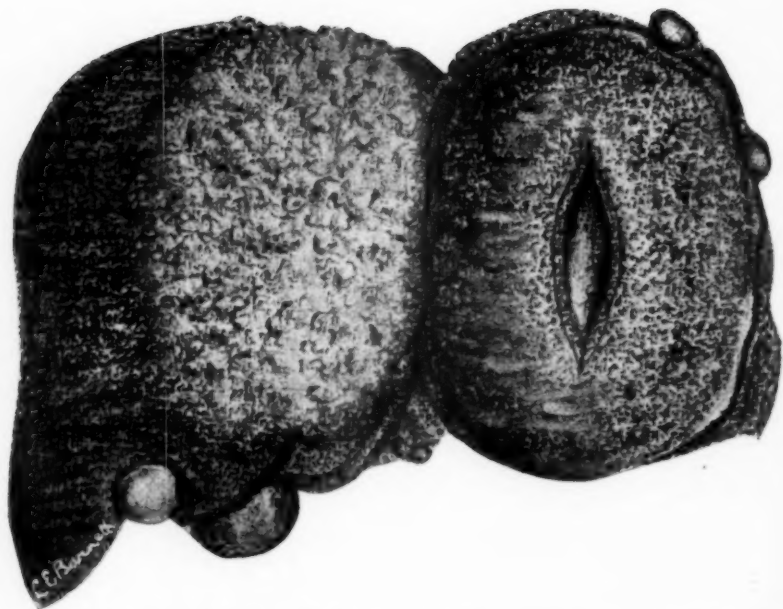


FIGURE I. Sketch in chalk by L. E. Barnett of the liver removed at autopsy, February 20, 1940, as seen from the front. Note firstly old large degenerated cyst in left lobe and other smaller but ordinary cysts elsewhere, all with clearly defined adventitia, and, secondly, the large infiltrating microvesicular alveolaris mass in right lobe.



